

ELECTRICAL CONTRACTING

OHIO STATE
UNIVERSITY

July, 1937

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Volume 36

Contents

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ELECTRICAL CONTRACTING

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July, 1937
Vol. 36 No. 7

With which is consolidated
The Electragist
and Electrical Record

Established 1901



A SERVICE PAPER for electrical contractors, engineers, motor shops, industrial electricians and inspectors, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction—industrial, commercial, residential

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STATE OF
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TOUGHNESS



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SHEATHED IN A HARD BUT PLIANT HIDE, the crocodile is better armored than a battleship! And toughness—the combination of hardness and elasticity—is the secret of his bullet-proof defense!

U. S. TEMPERED RUBBER INSULATION IS TOUGH! It's penetration-proof because it gives, yet resists...is hard but not brittle...elastic but not soft. Simple laboratory tests, available on request, prove the superior toughness of U. S. Rubber electrical wire and cable insulation...years of actual use in severest service demonstrate it! For your own profit, demand electrical conductors insulated with U. S. Rubber...tough...long-lived...dependable! United States Rubber Products, Inc., New York, N. Y.



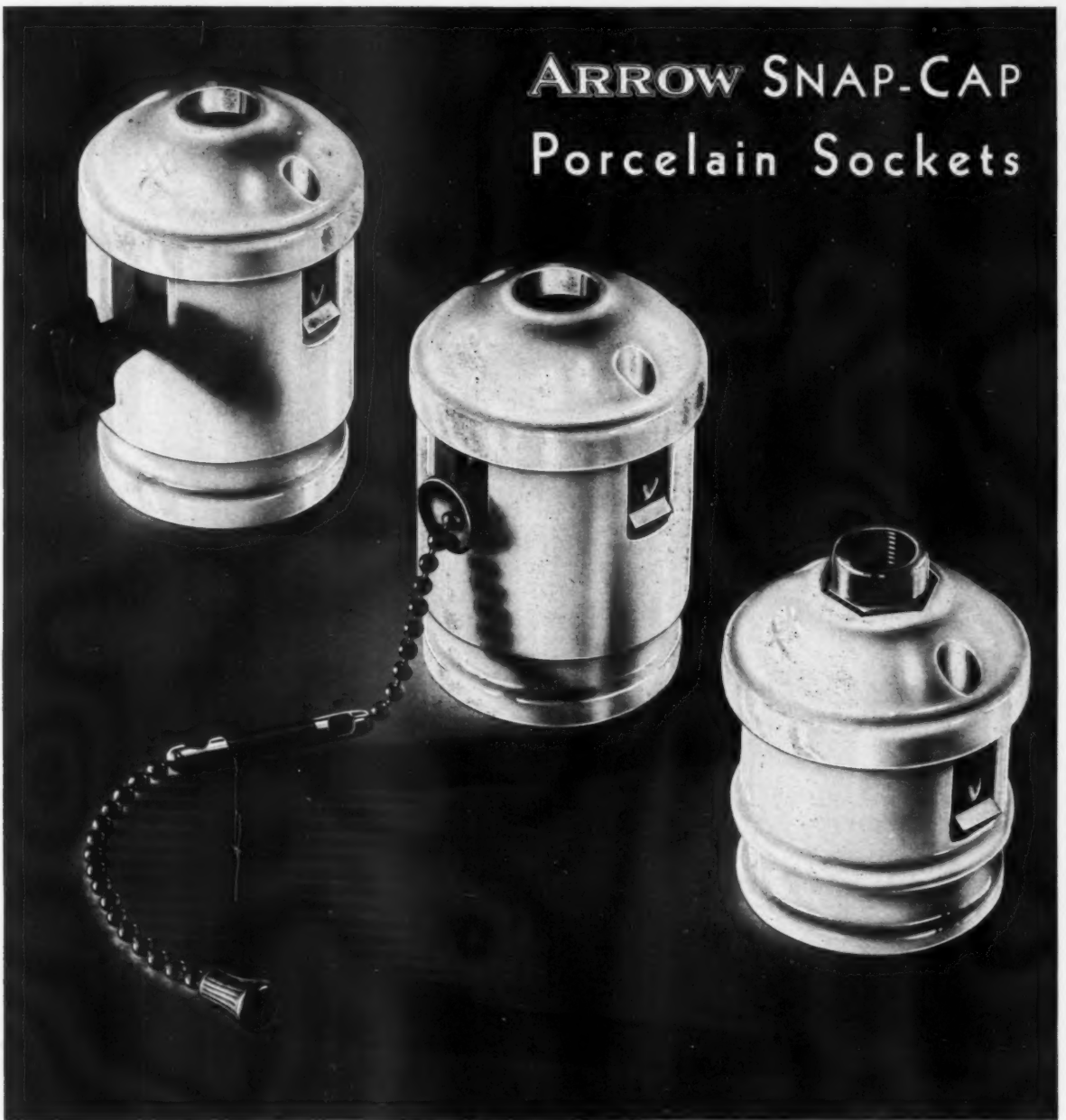
United States Rubber Company



Wire is only as good as its **Insulation**

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ARROW SNAP-CAP Porcelain Sockets



A useful, economical line for installation in places where dampness makes the porcelain socket preferable. Cap and body snap together easily and securely. Designed for easy wiring to the interior and a quick job of installing. Available only in assembled form; caps and bodies not sold separately.

The SNAP-CAP Line includes Key, Pull and Keyless types (illustrated), with Catalog Numbers and descriptions as follow:

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| Cat. No. | 9303 | - - | Pull with Pendant Cap. |
| " " | 9304 | - - | Pull with $\frac{1}{8}$ " Cap. |
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| " " | 9306 | - - | Key with $\frac{1}{8}$ " Cap. |
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Standard Package 100. Carton 10.

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ELECTRICAL WHOLESALER

Get Out Your Gongs!

WHEN A HOUSE BURNS, in a Chinese village, they pour no water on it. They dare not anger the Fire Demon. So the firemen turn out and beat on gongs and wave their flags. When the fire dies down, the demon has been scared away—the worse the fire, the greater the victory. It is an old Chinese custom.

FOR TWENTY YEARS a fire demon has been slowly creeping into American industry. A vast expansion in the manufacture of chemicals and the growing use of chemical processes in factories, have introduced explosion hazards that are taking a heavy toll in property and life.

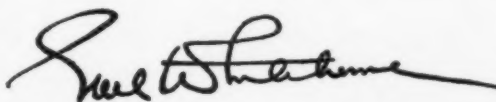
MANUFACTURERS EVERYWHERE HAVE ADOPTED these improved methods, that produce explosive fume and dust laden atmospheres. But many are quite unconscious of their peril. They are neglecting to safeguard themselves. It is an old American custom.

AN ELECTRIC SPARK from a switch, motor or other contact is one of the greatest sources of danger. So explosion proof wiring has been developed, to make electrical equipment safe in hazardous locations. It offers a gold mine to the electrical contractor. For wherever the air is filled with explosive gas or dust, there is an order waiting. Yet this opportunity is also being neglected. It is an old custom among contractors.

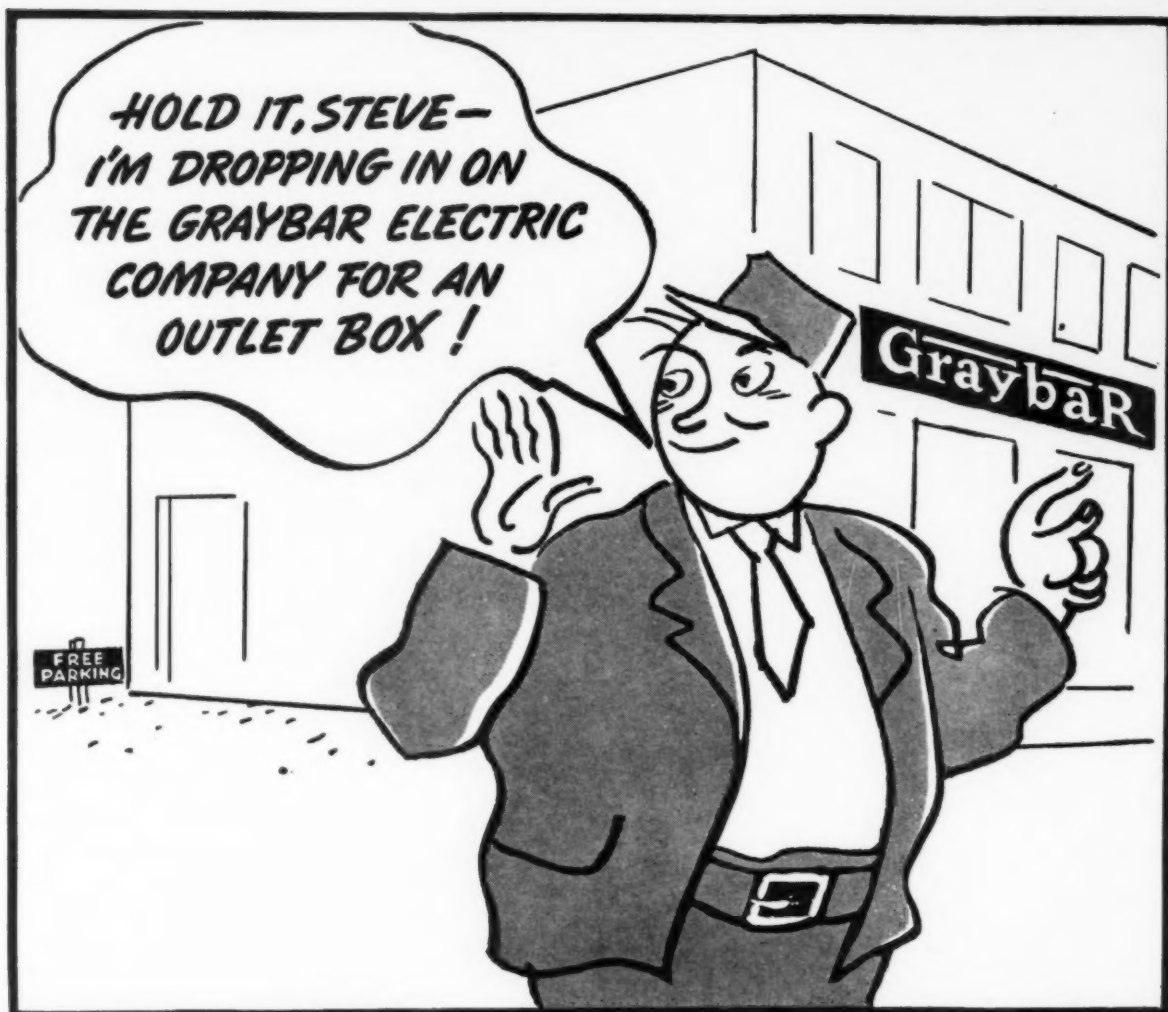
IT IS TIME TO GO AFTER this explosion demon. You will find him all about you, lurking unnoted in the factories of your best customers. You can point him out—if you will learn his ways. You can draw his fangs and cut his claws and be rewarded for it.

EXPLOSION PROOF WIRING COSTS MONEY. But it is cheaper than explosions. So the contractor need only run down the hazard and show the risk to get the job. It is one of the most profitable fields to specialize in right now, one of the most constructive services he can render.

A CHECK LIST OF THESE OPPORTUNITIES—gases, dusts, processes, locations—is presented in this issue with other guiding data. Study it. Analyse this local market. Prepare yourself to recommend and install explosion proof wiring. Then get out your gongs!



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If you need an item in a hurry...small or big...there's a quick, convenient place to get it. Graybar. We've stepped up our facilities for handling pick-up purchases. Look to Graybar

for quick, intelligent counter service... by men who know your needs. Ample stocks. Convenient parking facilities... We're geared to serve the Electrical Contractor from A to Z!

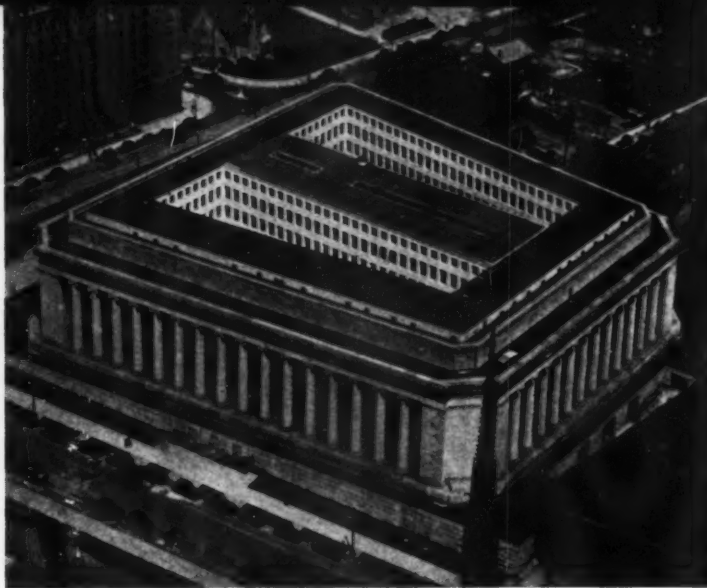
**Everything electrical for all
types of construction—**

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EMBELLISHMENTS of Botticino marble, mahogany, wrought metals, leaded glass, build a classic background for research.



THE MELLON INSTITUTE, Classic Grecian, with sixty-two 60-ton one-piece stone columns on its four sides, is hailed as the finest example of modern masonry. The building forms a hollow square providing two interior light courts.

Wiring for Research

Pittsburgh's New Mellon Institute Provides Industrial Scientists with an Electrical System Planned for Laboratory Service.

RESEARCH WORKERS—Scientists, who hold institute Fellowships, work here in two hundred laboratories, like this one, located on eight floors.



WHEN the world of science gathered on May sixth to dedicate the new building of Mellon Institute—Pittsburgh's Temple of Scientific and Industrial Progress—technicians found many innovations, provided for the advancement of industrial product development. To the structural engineer and architect, this six million dollar Parthenon of granite and limestone symbolized the beauty of classic design and won a new distinction in monumental building. And those who looked within found a veritable honeycomb of engineering laboratories—chemical, electrical, mechanical, metallurgical—housed in one of the most highly specialized structures ever conceived.

Designed as a workshop for the research men of industrial America, operating under academic fellowships, the Institute offers laboratory facilities to meet every conceivable requirement for scientific explorations. Complex devices and equipment are available for conducting all manner of experiments and tests, ranging from air pollution control to determining the texture of stone or making better shoes or improving shaving materials. And supporting these facilities is a bewildering maze of ducts, arterial systems carrying air, water, gas,

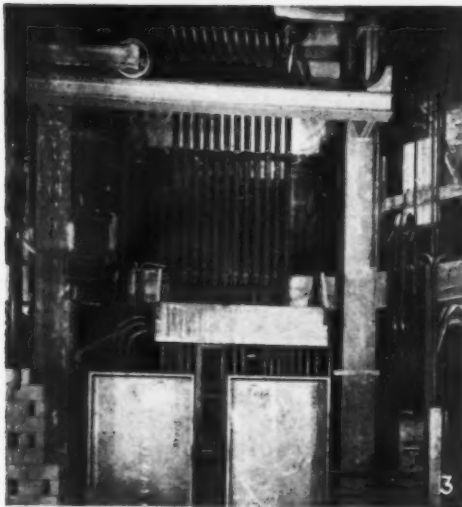


1. LABORATORY FACILITIES were provided to meet all anticipated electrical needs for the life of this structure. Typical corridors have three 2½-in. conduits (2 are spares) along each side to rows of flush tap-off boxes, from which connections lead to separate circuit-breaker panels in each suite.

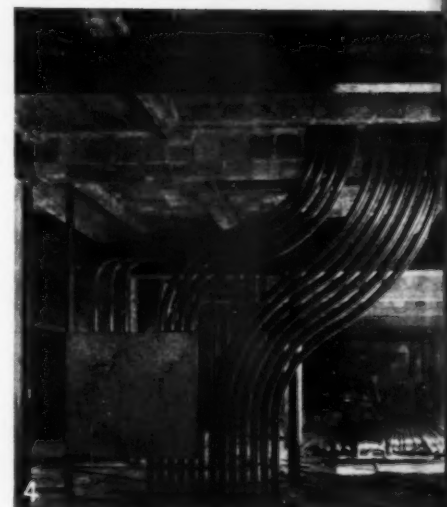
2. COORDINATED RACEWAYS in the five riser shafts connect to distribution centers designed to accommodate more circuit breaker units, if future loads require them.



3. INDUSTRIAL development in the unit-plants required a dense yet flexible network of heavy power lines. This is one of the feeder centers in the rough. The two circuit breaker cabinets are 7 ft. high and 5 ft. wide.



4. EASY PULLING of riser cables was insured by graceful sweeps in special 20-ft. lengths of 3½-in. conduits, worked out in detail drawings.



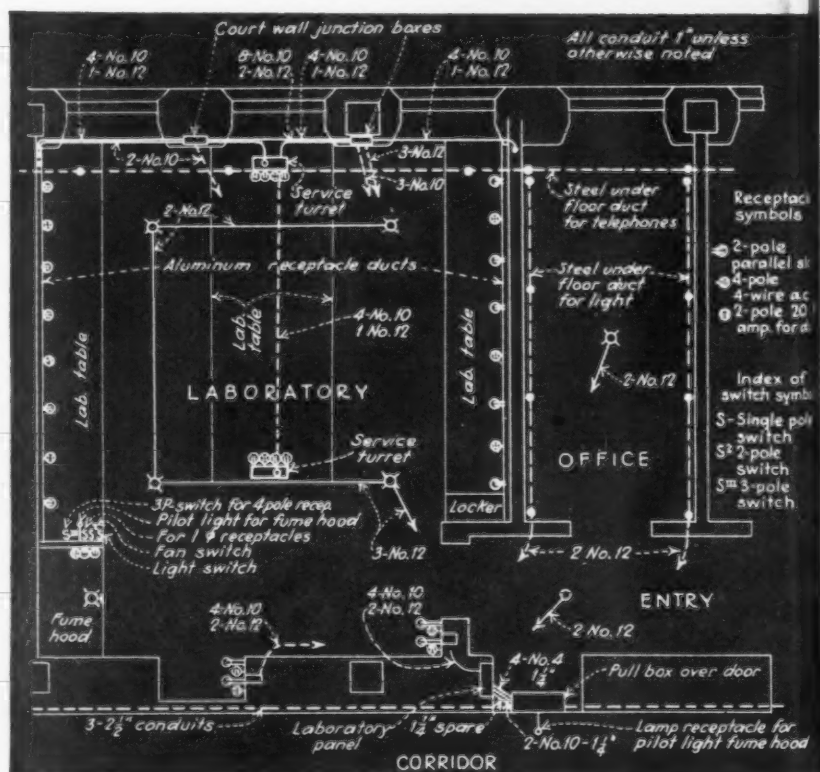
(Below) CONVENIENT RESEARCH, from the electrical point of view, is pictured by this typical laboratory wiring plan.

steam and electricity throughout the building and removing both fume and fluid wastes.

Some 200 individual laboratories are provided on the eight floor levels of the building, in which there are 6,500,000 cubic feet of floor space. In addition, there are a large library, a theatre or auditorium seating 350 persons, general offices, service and machinery rooms—altogether about 400 rooms for various uses.

The electrical services are extremely diversified. They must operate electric-eye-controlled elevators, provide intercommunication throughout this little city of scientists, remove chemical fumes, pump air and water, and give unlimited power for elaborate testing machines, as well as special power sources for chemical analysis. They must energise delicately adjusted air conditioning apparatus, X-ray and spectroscopic instruments, ceramic furnaces, and heating devices for nutritional studies. Lighting, of course, embraces all types from 500 watt high bay units to explosion-proof fume hood reflectors, to library stack illumination.

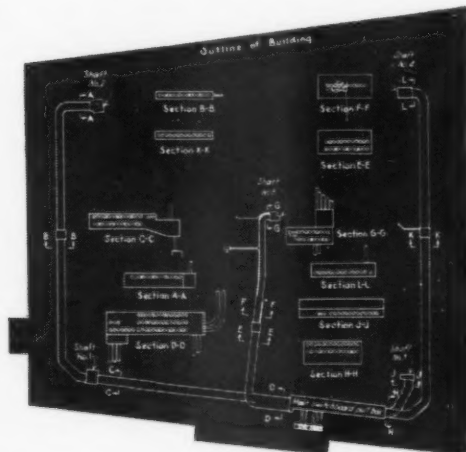
It took six years to build the Institute, and the Iron City Engineering





PLANNED RACEWAYS included rack designs to accommodate patterned 3½-in. conduits. Ceiling inserts and adjustable steel supporting members, give an orderly pipe assembly, without running threads.

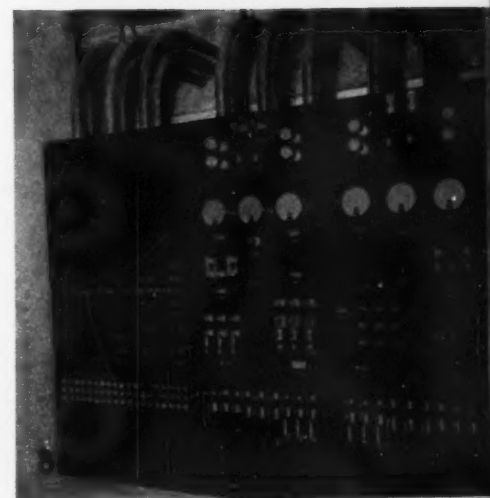
COORDINATED RACEWAYS fit the structural design and leave clearance for other heavy piping. The heavy lines are the massed runs of 3½-in. conduit leading out from the main pull box to five riser shafts.



6. MASSED FEEDERS required a main pull box, in the corridor outside the switchboard room, that measures about 64 ft. long by 8 ft. wide, to accommodate ninety-seven conduits of 3½ in., and their 300,000-C.M. conductors converging from five shafts.

7. MAIN DISTRIBUTION facilities require a seven-panel switchboard with 4000-amp. main breaker, and bus connections from transformers in a rear room. The vault has three 250-kva., 22,000-volt transformers, but is designed for six 500-kva. units.

8. SPECIAL CURRENT for the laboratories is obtained from 5 and 25 kw. d.c. generators. Risers are plugged in on the left panel in series with demand-limiting circuit breakers that are also included on the circuit plugging panel, in a choice of current ratings.



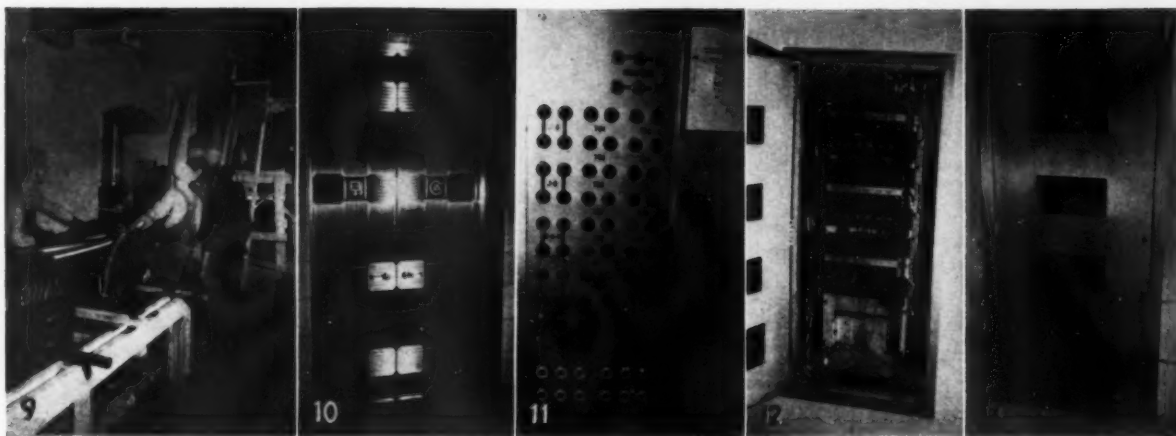
Company's electrical force has been on the job nearly all of that time. In working out every exacting detail for this job, they followed an electrical design that was conceived by James Paul Warner, the Institute's electrical engineer, in cooperation with Janssen and Cocken, architects, and Harry S. Coleman of the Institute's executive staff.

Electrical equipment, materials and workmanship had to be of a quality in keeping with the finest and most enduring structural materials that modern engineering technique could procure. Furthermore, raceway and conductor capacity had to be provided, with such leeway as to preclude any future cutting or chasing of the finished structure. An electrical job of over \$800,000 is the result of this long-range planning. It took about 1000 drawings to carry out all electrical details to perfection.

The Institute measures 306 ft. wide

at the front, 228 ft. wide at the rear and 335 ft. deep, and is supplied with power from five riser shafts. The main feeders to these risers were standardized at 7-300,000 c.m. conductors each, in 3½-in. conduit. There are 97 such runs, leaving the main switchboard. A main switchboard junction box, set flush in the corridor ceiling, measures 64 ft. long, 8 ft. wide and 30 in. deep. To route the feeder conduits in proper sequence required racks to hold twenty-eight conduits of 3½-in. for considerable distances.

To provide feeder raceways, offering a minimum pulling resistance to long runs of cable, the conduit in all long runs was laid out and installed to avoid sharp turns or deflections. Where a large group of conduits made a 90-degree turn, this was accomplished by making sweeps. To make these sweeps uniform, it was necessary to employ



DESIGNED FOR PERMANENCE: 9, Pulling 510-ft. runs made easy without use of lubricants, 10, These ornamental doors conceal a.c. and d.c. panelboards, 11, Plugging for d.c. at laboratory cabinets, made foolproof with flexible cables and jacks to fit color-coded

receptacles, 12, Reserve space was provided in laboratory lighting and power panelboards, by using special mountings for externally-operable breaker units, 13, Panel fronts were aluminum, anodic finished, with door openings for the breaker levers.

special 20-ft. lengths of 3½-in. conduit. Bends of this type were made on a large bench, where the large-radius sweeps could be compared with a graduating pattern or design.

The conduit work in corridors, adjoining various laboratory bays, was a combination of ceiling-suspended and side-wall routing. Here it was necessary to coordinate large conduits with other piping, to meet a compact layout of equipment, yet also serve an unusually dense system of local or suite panelboards. Although all of the local feeder, sub-feeder and branch circuit conduit work was subject to considerable bending and deflection, it was all planned and installed without the use of running threads.

Except for certain signal wiring, and isolated switch legs, all conduit was 1-in. or larger. To serve some 3500 fixed outlets, the wiring system also included much fiber and metallic under-floor duct. The use of exposed wireways at tables in the laboratories offered greater convenience for meeting a dense plugging receptacle requirement.

A Balanced System

A color coding system was used throughout the Institute's network of feeders and circuits. This being a 3-phase, 4-wire system, the color code was also made the basis for balancing the load. Red, yellow and black were chosen as the phase colors, and white for the neutral conductor. The d.c. conductors, for the laboratories, were coded blue for positive and green for negative polarities. Remote control conductors for motor starters were coded yellow, red, brown and white.

The heavy-duty outlets in laboratories, for instance, were connected in a

balanced rotation to phase conductors. Likewise, the general lighting circuits were arranged in their order of normal use, so that always-on lights, as in corridors, are well balanced on three phases. A further advantage of colored phase conductors was demonstrated by the facility with which the numerous 4-pole 3-phase receptacles were connected, so as to get the same direction of rotation from motors plugged into any receptacle.

There are distribution centers for each floor at each of the five riser shafts, and many small scattered panels are supplied by sub-feeders radiating from each center. The color coding system also simplified balancing the load on each of the riser cables. This was done by assigning color combinations for each floor, as a guide to begin making branch circuit connections. Starting with the first circuit at each panel on every floor, the phase connections and their order of rotation is: 1st floor, RYB, (red, yellow, black); 2nd, BRY;

3rd, YBR; 4th, RYB; 5th, BRY; 6th, YBR; 7th, RYB; 8th, BRY; 9th, YBR. Once established, this installed system is reasonably well staggered on phases. Moreover, it puts the entire network on a foolproof basis for future maintenance.

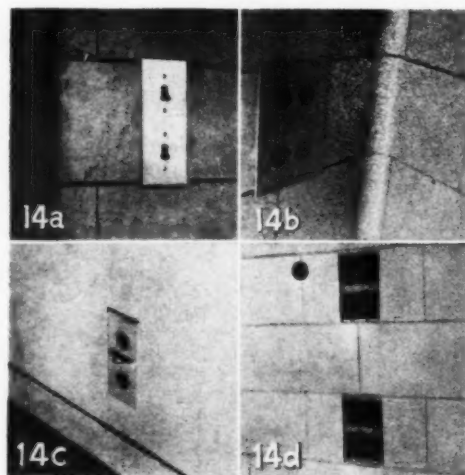
Flexible Distribution Centers

In adapting circuit breaker units to the general scheme of over-current protection, an unusually flexible panel-board design was worked out. Both the feeder distribution centers and the branch circuit panels employed cabinets, specially designed to permit future additions or to facilitate future re-arrangement of individual circuit breaker units. Space was allotted everywhere, for mounting these extra-size cabinets. At no future time is it likely that other cabinets need be installed.

The layout was designed for a decentralized branch circuit system. All interconnecting raceways, also being of

(CONTINUED ON PAGE 45)

14. OUTLET DESIGN was necessarily exacting, to suit interior masonry as well as to meet future needs. (a) Switch boxes were made to fit courses of finished tile and required tandem plates 9 in. high and 3½ in. wide. (b) Four laboratory receptacles were ganged under one course-fitting anodic-aluminum plate to provide two 2-pole and two 3-pole outlets. (c) Vacuum cleaner outlets in corridors were combined for single or 3-phase equipment. The yoke-equipped plate permits hook-on strain relief for cords. (d) Boxes for grouped switches and plugs fitted tile courses, and were 6 in. deep for connecting several 1½-in. conduits without damaging the masonry.





SOCKETS AND MULTIPLE UNIT TROUGHS for different arrangements and forms of wiring.

Plug-In For Facts

By B. R. Hill

Manager, Instrument Sales Section, Westinghouse Electric and Manufacturing Co., Newark, N. J.

THE electrical contractor can now install fact-finding sockets for using detachable measuring instruments at various motors. It is all a matter of putting in standardized instrument sockets at convenient places on machines or at controllers. Once installed, these sockets can be used for a plug-in test with a voltmeter, ammeter, wattmeter or watt-hour meter.

This development marks the end of long shutdowns in busy plants while connecting up measuring instruments used to make periodic tests. Furthermore, a limited stock of detachable instruments can be used for making alternative tests all over the plant, when a liberal number of sockets have been provided. It simplifies the measuring of power consumption and process functions, and checking motor loads, overloaded wiring, worn equipment, dull tools, and other causes of power waste or reduced efficiency.

This new development offers contractors new business possibilities in the installation of instruments for the measurement of electrical input to industrial equipment. The detachable-from-socket idea, which revolutionized the installation practice of public utility company watt-hour meters, is the basic idea now adapted to instrument practice.

The detachable instruments are used with an aluminum alloy socket equipped with threaded conduit outlets. The instrument unit has connection blades for plugging into the socket, thus completing the circuit from the socket through the instrument automatically. The socket provides a complete support for the instrument. No panels or extensive wiring are necessary to apply a detachable instrument. It is equipped with contacts or jaws fitted with solder-

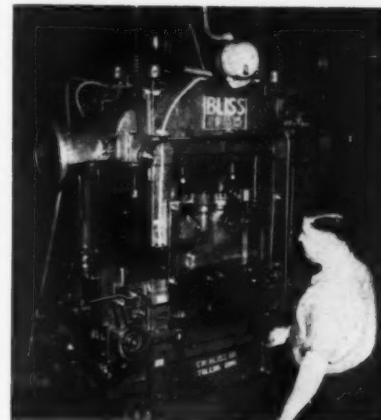
less terminals, to which the incoming and outgoing wires are connected. Sockets are available in a variety of sizes and number of threaded outlets. Where several instruments are required, the sockets can be grouped in boxes or troughs, which can be connected with conduit. Such units are available in combinations of two, three or four instrument positions.

After a socket has been mounted and connected, the installation is completed by plugging in the desired instrument, whether it be ammeter, voltmeter, wattmeter or watt-hour meter. Convenient circuit closing devices are provided, which plug into spare sockets. These spares can be sealed off until such time as instruments are to be used.

Detachable instruments are provided in a.c. ammeters up to 75 amp. self-contained. For larger currents a current transformer is used with a 5-amp. detachable instrument. Single and poly-phase wattmeters are available, self-contained up to and including 20 amp. and 115 volts, while for higher ratings, current and potential transformers are used. D.C. ammeters are provided up to and including 30 amp. self-contained, beyond which a line of shunts is available for larger currents. A line of self-contained voltmeters is provided in ranges from 150 to 750 volts d.c., and 150 to 600 volts a.c.

When current and potential transformers are required, suitable steel enclosures can be obtained for wall mounting. The instrument and socket units still can be mounted in the conduit at the machine if desired. Sockets are equipped with automatic closing devices to short circuit current transformer secondaries, when the instrument is removed from the socket.

DETACHABLE AMMETER on feeder of pulverizing machine. Feeder is adjusted to definite indication on ammeter dial.



HIGH SPEED PUNCH PRESS instrument installation. Socket is in plain view of machine operator.

VARIOUS FORMS of instruments may be plugged into the same socket, including ammeters, voltmeters, wattmeters or watt-hour meters. (Below)



ON THE WALL—Explosion proof junction box, De-ion breakers, watt-hour meter and across-the-line starter, installed out doors.



By Karr Parker

*President, McCarthy Bros. & Ford
Buffalo, N. Y.*

Extremely Hazardous Conditions Requiring Explosion Proof Wiring—With Problems Illustrated By a Recent Large Installation

ONE of the most difficult present day electrical engineering and construction problems is that of installing equipment and wiring in Class I hazardous locations. Thus a large oil refinery producing gasoline probably represents the greatest hazard, because of the volume of dangerous gasoline and vapor always present.

Refineries were originally operated largely by steam equipment. Boilers generated steam from crude oil and supplied it to steam pumps, compressors and engines, scattered around over the refinery. This was a comparatively inefficient and expensive method of supplying power, because of the high steam consumption of the steam equipment, which was operating non-con-

densing. Also, the long steam lines condensed and wasted a great deal of steam, particularly in cold weather.

Not long ago, we were called in by a large refinery to see if it would be possible to reduce these losses, increase production and secure more reliable and dependable service. A study was made of the feasibility of electrifying this operation and the savings that could be effected. Many novel problems had to be solved.

It was necessary, for example, to develop for this application new electric motor starters, of a special oil immersed explosion resisting magnetic type. Special explosion proof housings for circuit breakers and panelboards, had to be devised. Patterns were made and castings poured and machined, so as to thoroughly protect the electrical apparatus from the flammable and explosive gasoline vapors present.

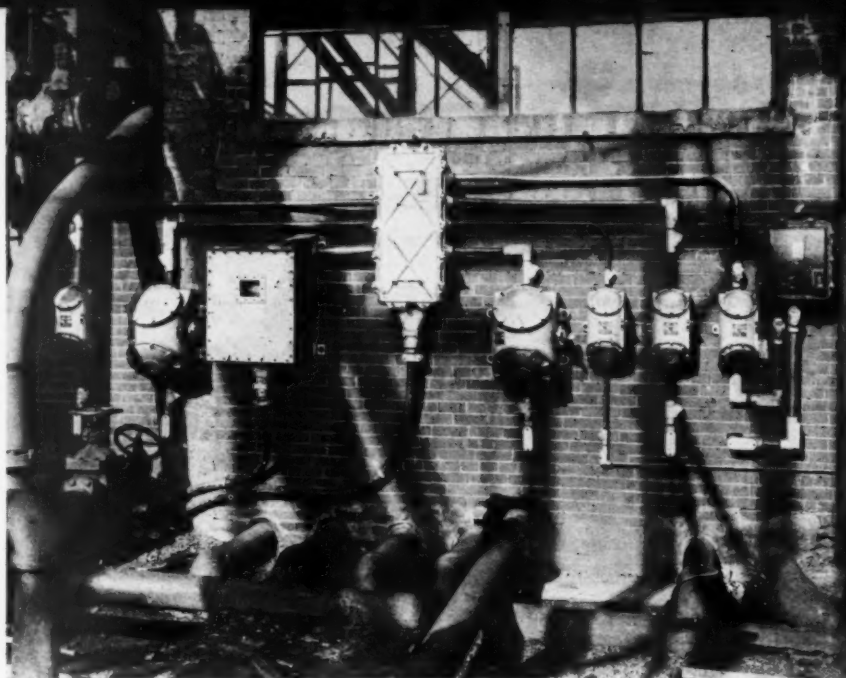
The power supplied to the refinery is three phase, 60 cycle, 4157 volts. It enters the plant through an underground cable to the high-tension switchboard, located in the transformer room, outside of the dangerous zone. In the adjacent power house was located 2-500 kva., 3 phase, 60 cycle, 480 volt turbo-generators. They had been supplying the electricity required for the lighting and power in the non-explosive portions of the plant, which amounted to approximately 400 kw. These units were shut down and arranged with an inter-

locking switching arrangement, between the new outside power bus and the old switchboard, so that they could be called upon for service emergency. The electric load in the plant is fairly steady, at 1700 kw. with a power factor of 88 per cent, and is supplied by a 2000 kva., 3 phase transformer.

The steam pumps were generally replaced with centrifugal pumps, driven by totally enclosed, explosion proof, squirrel cage, induction motors, in sizes from five to 200 HP. These were controlled by explosion-proof, oil-immersed, magnetic starters, located outside of the pump houses, wherever practicable. No fuses whatever were used in the installation. The main feeders were protected by oil circuit breakers and the branch lines by De-ion circuit breakers, enclosed in cast iron explosion proof housings.

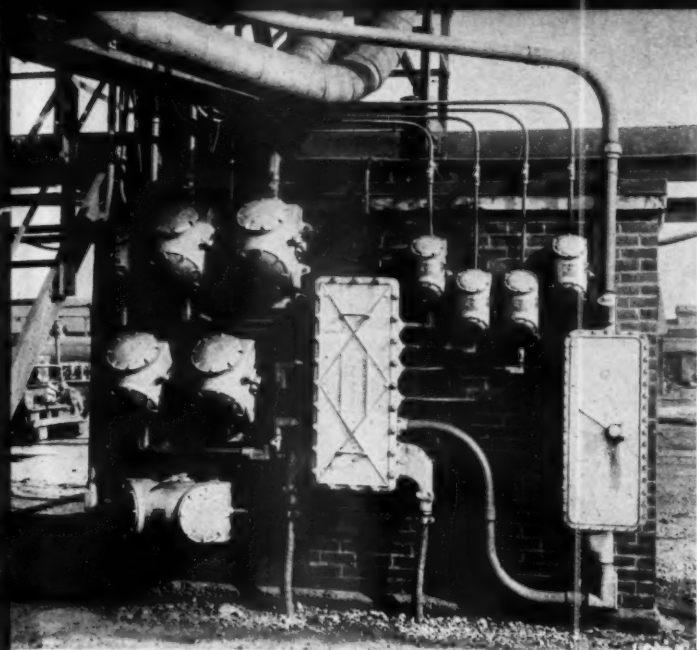
All of the wiring was of paper insulated, lead covered, parkway cable, run underground so far as the main feeders were concerned. The branches were in many cases run from a distributing point, such as that shown in the picture. Rubber insulated cable, in sheared steel conduit was run to the motors. The cases of the starters were arranged so that the oil tanks could be dropped to inspect the contacts; however, at such times the starting equipment is rendered inoperative through an inter-lock.

The lighting of the plant is supplied



Modernizing an

Electrical Contracting, July 1937



MAIN JUNCTION—Typical arrangement of main junction box and De-ion branch feeder breakers, in explosion-proof housings.

starters, are all tightly connected together in a continuous system, is the condensation of moisture inside the housings and conduits. This is undoubtedly due to the fact that the electrical equipment inside breathes. When the equipment is operating and current is flowing through the devices, the air contained expands and leaks out through the gaskets. When the current is off and the equipment cools down, a slight vacuum obtains and outside air is sucked into the system. If the humidity is high, this may result, over a period of time, in moisture collecting in the housing and causing trouble. In such cases, it is advisable to use a moisture absorbent, inside of the housing, such as calcium chloride. Regular inspections are advised.

All of the work, in an installation of this character, must be of the highest quality, and most carefully done. You are dealing with a continuous, integrated process and a failure of any important unit will involve a shut down of the entire plant. In this particular refinery, the saving made, by replacing the steam equipment with the electrical apparatus, and the steam lines with electric wiring, has amounted to more than \$100,000.00 per year. The operation of the equipment has been entirely satisfactory and reliable and the savings have shown a high rate of return on the capital investment required. It has also established the fact that electrical equipment and wiring, when properly designed and installed, gives safe and reliable service in hazardous locations of this kind.

Oil Refinery

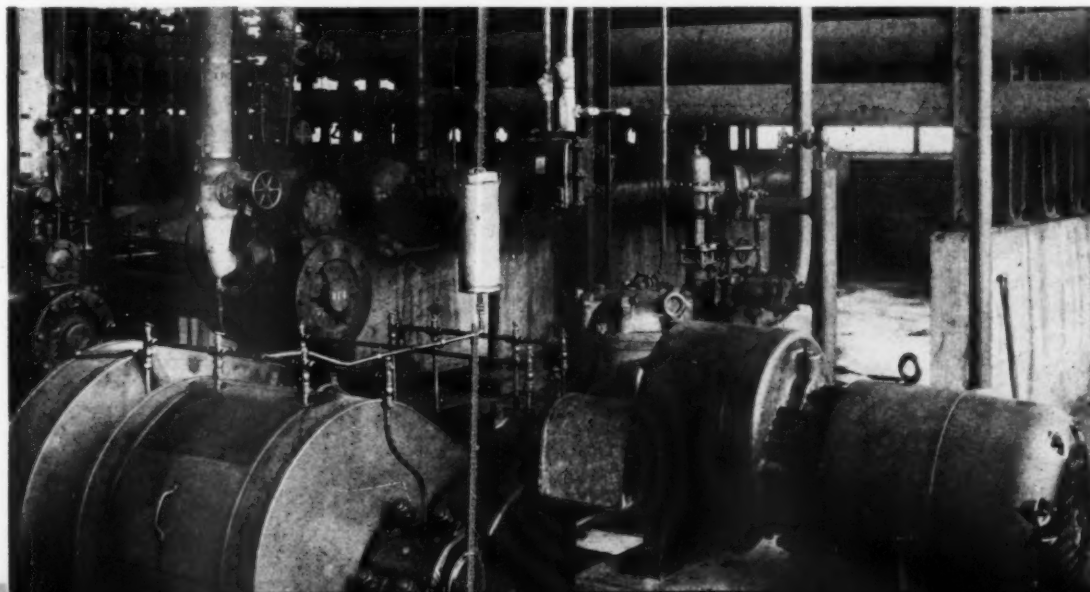
through a number of separate lighting transformers, located in various parts of the plant, and connected to the 440 volt feeders. It is vital, of course, to the 24 hour operation of the refinery, that lights located at important points, do not fail at any time.

A great deal of the lighting equipment is out of doors, consisting of floodlights and exterior illumination. In order to provide additional protection on this lighting service, against a possible interruption in the outside power, a small turbo-generator of 10 kw. capacity was installed in the power house, with a magnetically operated steam valve on the high pressure side. This valve is controlled by a relay ac-

tuated by a no voltage release on the incoming service. A double throw, magnetic contactor automatically transfers the necessary portions of the lighting load from the normal operation to emergency operation on the turbo-generator. With these provisions it is possible to automatically restore lighting service on the selected feeders within 40 seconds, after a power failure.

One of the difficulties that the electrical contractor may find in making installations of this kind, where the conduits, explosion proof housings and

ENCLOSED PUMP—Explosion proof housings on 20 hp. gear head motor and reduction gear installation on a pump.



Lighting the Used Car Lot

PYLONS AS POSTS—Here Cel-o-glass is stretched over steel framework and lighted from behind by 72 lamps, totalling 2,000 watts with curved sheet metal reflectors. Columns are lighted from below by floodlight reflectors. Behind the framework are seventeen 200-watt and two 1000-watt open type floodlights, directed on the cars.



LIGHT must fulfill a two-fold function in the used car lot. It should attract the favorable attention of all passersby, on foot or in automobiles. It should illuminate cars offered for sale so that they may be easily inspected by customers.

To attract favorable attention, luminous pylons are a "natural." That is because they combine the factors which make effective advertising—brightness, color, size, distinctive shape, legibility,

By J. A. Summers

General Electric Company
Nela Park Engineering Dept.
Cleveland, Ohio

repetition, beauty, individuality and dominant position.

Being a free standing element, the pylon requires no building for attachment. And when placed as near the curb as possible, so that it may be seen by motorists up and down the street, it affords identification from considerable distances.

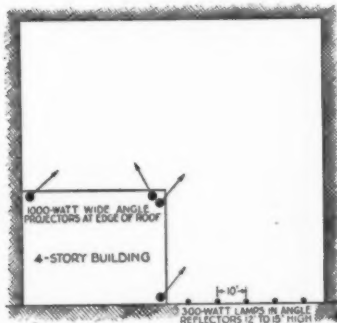
Brightness can be regulated by the size of lamp employed and should be selected to make the display outstanding among its advertising competitors. Depending upon location it should range from 100 to 300 footlamberts. (A foot-lambert is the brightness of a surface that emits or reflects one lumen per square foot. Brightness in footlamberts may be measured by placing the cell of a light meter against a luminous surface and multiplying by 1.25.)

The pylon will also serve as a column to hold the large sign frequently seen on used car lots mounted on posts

and extending perhaps the entire length of the lot. Pylons, used as posts, each one luminous and carrying its advertising message, provide a luminous colonnade and attract passing prospects.

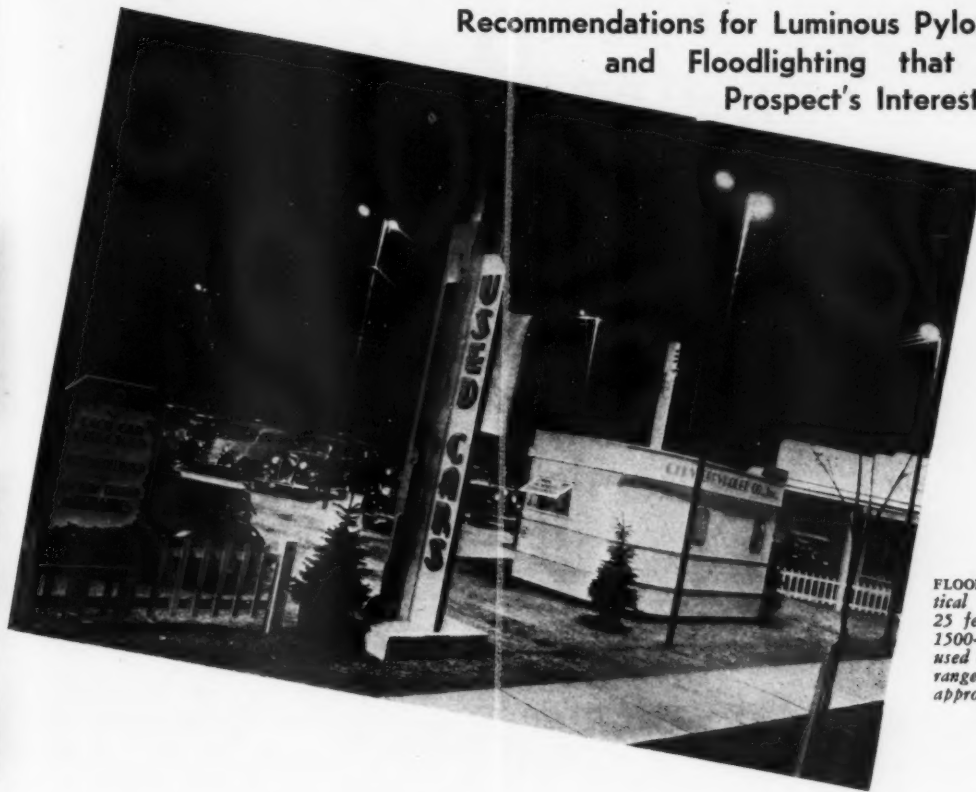
The advertising message on the pylons should be brief in order to obtain large size for the lettering and maximum legibility. Lettering may be painted on the luminous panels, or for permanence and durability, the panels themselves may be of ceramic glass, with the characters fired in color or in opaque materials on the glass itself. Other installations might have separate letters of wood or metal or composition attached to the frame in front of the glass panels, permitting change of name or change of copy, where price quotations are made.

Ceramic glass, cased opal glass, or various plastics are light-diffusing materials suitable for permanent installations. For more temporary structures, very satisfactory effects are produced by translucent fabrics, such as muslin, stretched over taut wood frameworks and lacquered or varnished as a protection against weather. Regardless of the material used, lamps should be spaced no farther apart than $1\frac{1}{2}$ times their distance from the surface of the



LIGHTING BACK—A good arrangement of floodlighting for the used car lot with inadequate frontage. It carries the interest to the rear.

Recommendations for Luminous Pylon Treatments and Floodlighting that Carries the Prospect's Interest to the Rear



FLOODLIGHTING—Thirteen elliptical angle reflectors, mounted 25 feet high and equipped with 1500-watt lamps, illuminate this used car lot, with no glare in the range of vision as the customers approach.

material to be lighted.

In all cases, the front row of cars should be well lighted to focus attention. This can be accomplished by angle reflectors, either suspended across the front of the lot on messenger cable and held rigid by guide wires, or mounted on individual poles. The reflectors should be spaced approximately 10 feet apart, mounted 12 to 15 feet high and equipped with 300- or 500-watt lamps, depending on local conditions.

The amount and type of this lighting needed depends on the size of the lot, its location and the grade of cars on display. On a large lot, it may not be necessary to illuminate the entire lot to a high level. An "inspection area" lighted to a level of 10 to 20 foot-candles may be featured.

Floodlighting is probably the most common method of lighting. Here it is necessary to mount the units high, to minimize glare and to prevent long shadows. Projectors should never be pointed toward the front. Mount them at least 40 feet high at the two front corners, directed toward the rear, with the beams crossing so that light strikes cars from more than one direction.

If the lot is more than 75 feet deep,

additional poles should be provided at the sides to throw light between the cars at the rear. The number and type of projectors depends on the size and shape of the lot. In general, however, a wide angle projector is required. The number needed can be figured roughly on the basis that, if an efficient projector is used, one watt per square foot of lot area will give an average of from 5 to 7 foot-candles on the horizontal plane.

Another good method is to mount 500-watt lamps in R.L.M. dome reflectors on 25 foot centers, 15 to 25 feet high, over the entire lot. The higher mounting is desirable because of the shorter shadows cast by the cars. The units may be mounted on messenger cable or on posts with mast arms.

Where the area is not symmetrical and only a small section of the lot borders on the street, a lighting method such as is shown in the sketch. may be employed with good results.

PYLONS ARE DISTINCTIVE—Several luminous pylons across the entrance of a used car lot attract attention and sell cars, for the best prospects come in the evening when families are driving out.



Motor Repairs Priced By S I Z E

THERE are many schemes for building up the selling price of work from labor and material costs. But basic labor and material costs varying appreciably with different shops. Costs also vary in any one shop, at different times or with different men, and with a corresponding variation in the price to the customer. From the customer's standpoint, however, there should be but a single fair market price for any particular type and size of repair job.

Why not use *average* labor and material costs, therefore, instead of the continually varying individual job costs? Also, why not go right to the point and set up a whole series of standard unit billing prices, based on *average* values of *all* the cost elements involved? There are hundreds of repetitive jobs, in the repair shop, that could be averaged by the industry and set up in suggested price tables. Such common jobs as turning and undercutting commutators, boring and bushing pulleys, winding of various types including field and solenoid coils, certainly adapt themselves to standard pricing.

A New System

So George P. Svendsen of Minneapolis has tackled the job and presents the accompanying table of prices, based on a series of frame sizes instead of horse power and speed, and embracing other repair operations besides winding. Under his plan, where frame size cannot be directly determined before quoting a price, auxiliary tables make it possible to select an approximate frame size from the horse power, speed, frequency, and service rating of the motor.

There are several advantages in this type of schedule. The prices are tied to a series of frame sizes, which are sufficiently definite to price special machines or obsolete types, where horse power and speed rating give misleading results. It will also take care of machines from which name plates have been lost or removed or altered.

When a schedule is built on horse power and speed ratings only, price



GEORGE P. SVENDSEN—president
Boustead Electric & Mfg. Co. of
Minneapolis.

comparisons between various shops are subject to substantial differences. This is due to corresponding differences in frame sizes, for the same rating with different makes of motors, or even with the same make but of different age. A familiar example is the old type "CCL" motor, with a core corresponding to later designs, but with 50 per cent higher horse power rating.

Another advantage of this schedule is that many additional operations can be included on a simple and accurate basis. For example, shaft and bearing work requires only 16 price groups. These 16 groups cover all ratings within the schedule range, which in the 60 cycle, 40 degree open ratings, comprises over 200 listings. If all the various other frequency and temperature ratings are included, the usual horse power-speed schedules necessitate almost one

A new system for pricing repair work by a table of physical dimensions, instead of the usual maze of motor ratings. Abstracted from a paper presented George P. Svendsen of Minneapolis before the recent NISA Convention in Chicago.

hundred shaft and bearing prices; whereas in this table, only 16 different shaft sizes are shown.

At the same time, this schedule lends itself to averaging winding prices, as it only requires 26 winding sizes and 16 shaft and bearing sizes to cover thousands of ratings. These frame sizes and prices were determined from a study of winding record cards, accumulated over a period of years. The D²L values were obtained from calculated values based on average design constants.

There is always a difference of opinion as to the percentage to add for 2300 volt windings, due to the fact that some base their figures on small ratings and others on large ratings. Quite frequently in the smaller ratings, the high voltage motor has a larger frame size than the low voltage motor of corresponding horsepower, while in the larger ratings the frames were identical.

A Simple Basis

But here, the price is based on frames and a flat addition is made for the high voltage winding, which seems to hit closer to actual cost conditions than any percentage plan. In small ratings, there is a jump from mush to formed and taped coils, plus the extra insulation, while in the larger ratings both high and low voltages use the formed and taped coils. Extra insulation and extra coil cost is the only difference. The larger the motor, the closer the insulations approach each other in construction and cost. So in spite of increase in size, the cost difference is practically constant, as shown in the schedule.

In conclusion, it is well to point out that the prices shown in this new schedule represent but a single shop's experience and, of course, may differ for other shops. However the method of pricing by frame sizes is offered so price comparisons between different shops can be tied down to something definite. This will eliminate the variations that are present when motor repair work is priced by rating only.

Electrical Contracting, July 1937

MOTOR REPAIR PRICES

For 110 to 550 Volts—2 and 3 Phase—60 Cycles

Frame Reference		Average Core Data			Standard Operation Prices															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
N. I. S. A. frame classification	N. E. M. A. frame	Range in air gap, diameters "D"	Range in core widths "L"	Average "DPL"	General fixed charges	Rewind stator	Rewind rotor	Weld Sq. cage rotor	Reconnect for voltage	Reconnect for phase		Average Shaft Extension size	Average Bearing size	Standard bearing	Special undersize bearing — turn shaft	Ball bearing	Arc-weld shaft and machine	Put in new shaft	Put on standard shaft extension	Each additional 5' of shaft extension
A	.....	3 1/4 - 4 1/4	1 1/4 - 1 3/4	25	\$1.5	\$16	\$18	\$3	\$3	\$4.5	.....	1 x 1 1/2	1 1/2 x 1 1/2	\$8	\$1.1	\$2.5	\$1.5	\$3	.....	.....
B	.....	4 - 4 1/4	2 - 2 1/4	35	1.5	19	21	3.5	3	4.5	.....	1 1/2 x 1 1/2	1 1/2 x 1 1/2	1	1.5	3	2	4	.....	.....
C	.....	4 1/4 - 5 1/4	2 1/4 - 2 3/4	45	1.5	20	22	4	3	4.5	.....	1 1/2 x 1 1/2	1 1/2 x 1 1/2	1.2	1.4	3	2	5	.....	.....
D	204	5 - 5 1/4	2 1/4 - 2 3/4	60	2	21	23	4.5	3	4.5	.....	1 1/2 x 1 1/2	1 1/2 x 1 1/2	1.3	1.5	3.5	3	6	.....	.....
E	224	5 1/4 - 6	2 3/4 - 3	75	2	24	26	5	3	4.5	.....	1 x 2 1/2	1 1/2 x 2 1/2	2	2.3	4	4.5	7	.....	.....
F	225	5 1/4 - 6 1/4	3 - 3 1/4	100	3	27	30	5.5	3	4.5	.....	1 x 2 1/2	1 1/2 x 2 1/2	2.3	2.5	4.5	5	8	.....	.....
G	225	6 - 6 1/4	3 1/4 - 3 1/2	125	3	30	33	6	3	4.5	.....	1 x 2 1/2	1 1/2 x 2 1/2	2.3	2.5	5	5.5	9	.....	.....
H	254	6 1/4 - 7	3 1/2 - 3 3/4	150	4	34	37	7	4	6	.....	1 1/2 x 3	1 1/2 x 3	2.7	3	5.5	5.5	12	.....	.....
I	284	7 - 8	3 3/4 - 4	200	4	39	43	8	4	6	.....	1 1/2 x 3	1 1/2 x 3	3.2	4.2	6	6	15	.....	.....
J	324	8 - 9	4 - 4 1/4	260	5	48	53	10	4	6	.....	1 1/2 x 4	1 1/2 x 4	5	6.6	7.5	7.5	22	12	.....
K	326	8 1/2 - 10	4 1/4 - 4 3/4	345	6	56	62	11	5	8	.....	1 1/2 x 4	1 1/2 x 4	5	6.6	7.5	7.5	24	12	.....
L	364	9 1/2 - 11	4 3/4 - 5	440	7	63	70	12.5	5	8	.....	1 1/2 x 5	2 x 5	6.5	8.5	11	7	28	13.5	.....
M	365	10 - 11 1/4	5 - 5 1/4	500	7	70	77	14	5	8	.....	1 1/2 x 5	2 x 5	6.5	8.5	11	7	30	13.5	.....
N	404	10 1/2 - 12 1/2	5 1/4 - 5 3/4	640	8	80	88	16	5	8	.....	2 1/2 x 6	2 1/2 x 5 1/2	8	10.6	14	8.5	35	15	.....
O	405	11 1/2 - 13 1/2	5 3/4 - 6	770	9	91	100	18	7	11	.....	2 1/2 x 6	2 1/2 x 5 1/2	8	10.6	14	8.5	37	15	.....
P	444	12 - 14	6 - 6 1/4	960	10	100	107	20	7	11	.....	2 1/2 x 6	2 1/2 x 6	10	13	17	11	45	16.5	.....
Q	445	13 1/2 - 15 1/2	6 1/2 - 7	1,170	12	122	130	25	7	11	.....	2 1/2 x 6	2 1/2 x 6	10	13	17	11	48	16.5	.....
R	504	14 - 16 1/2	7 - 7 1/2	1,400	14	130	139	26	10	15	.....	2 1/2 x 7	2 1/2 x 7	12	15.6	25	13	58	18	.....
S	505	15 - 17 1/2	7 1/2 - 8	1,690	16	151	162	30	10	15	.....	2 1/2 x 8	3 x 7 1/2	14	18.4	42	15	65	19.5	.....
T	.....	16 - 18	8 - 8 1/2	2,060	18	187	200	37	15	23	.....	2 1/2 x 8	3 x 7 1/2	14	18.4	42	15	70	19.5	.....
U	.....	17 1/2 - 20	8 1/2 - 9	2,615	20	209	223	41	15	23	.....	3 1/2 x 9	3 1/2 x 8 1/2	19	25	50	20	85	21	.....
V	.....	18 - 21	9 - 9 1/2	3,000	22	249	266	50	15	23	.....	3 1/2 x 9	3 1/2 x 8 1/2	19	25	50	20	90	21	.....
W	.....	19 1/2 - 22 1/2	9 1/2 - 10	3,800	25	286	306	58	20	30	.....	3 1/2 x 9	3 1/2 x 8 1/2	19	25	50	20	100	21	.....
X	.....	21 - 24	10 - 10 1/2	4,850	29	300	320	60	20	30	.....	3 1/2 x 11	4 x 10	24	32	68	26	110	24	.....
Y	.....	22 - 25 1/2	11 - 11 1/2	5,720	33	340	363	70	25	40	.....	3 1/2 x 11	4 x 10	24	32	68	26	115	24	.....
Z	.....	24 1/2 - 28 1/2	12 - 12 1/2	7,500	38	375	400	75	25	40	.....	4 1/2 x 12	4 1/2 x 11 1/2	30	40	12.5	33	150	30	10

FRAME SIZES FOR 40° C. CONTINUOUS OPEN RATINGS, 110 TO 550 VOLTS, 2 AND 3 PHASE, 60 CYCLES.

Syn. R.P.M.	Horse Power																			
	1/2	3/4	1	1 1/2	2	3	5	7 1/2	10	15	20	25	30	40	50	60	75	100	125	150
3,600	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1,800	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1,200	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
900	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
720	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
600	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
514	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
450	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q

NOTES:

- Column No. 6 — A fixed charge applying to every job for checking, dismantling, cleaning, etc.
When rotor or stator only is sent in use 1/2 this charge.
For gear head and vertical motors use 1 1/2 times this charge.
For totally enclosed fan cooled motors use 2 times this charge.
- Column No. 7 — Rewinding as listed for 4-6-8 pole stators, 110 to 550 volts single speed.
For 2 pole stators add 30%.
For 10-12-14-16 pole stators add 10% except for frame "S" and larger.
For 2300 volts add \$45.00 on all frames.
For 2 winding 2 to 4 speed add 60%.
For 1 winding 2 speed add 5%.
- Column No. 10 — Covers interchange 110-220 or 440 volts. No new leads included.
- Column No. 15 — Does not include oil ring or wool packing. Add 10% for either.
- Column No. 17 — For smaller bearing opposite pulley end use 60% of this charge.

Looking In on Ralph Walker



Third in a series of informal
visits to interesting contractors

By Earl Whitehorne

DOWN in Atlanta, not far from Peachtree Street, where Scarlet drove away the night the Yankees came, and left the oil lamp burning yellow in the middle of the road—if you know your *"Gone With The Wind"*—Well, not far from there, in a red brick factory building, is the Walker Electrical Company. That means Ralph Walker, who is N.E.C.A. executive committeeman for the eight southeastern states.

In March, I spent a few days with him at the Southeastern Conference. It was a great meeting, contractors, wholesalers, manufacturers and power company men from eight states, setting up a program for team work in developing the electrical market. It was Walker's idea, and they came at his call

from the entire area, one of the most enthusiastic, purposeful meetings I have ever attended—and a fine tribute to Walker.

I watched him handle the program and liked the way he worked. I wanted his story for this series, but I ran into trouble. He is one of the most modest men I know. So I had to go into a corner with his life long friend and partner, K. D. White. Ralph spotted us and tried to take my notes. But I hung on to them. For here is another man who has carried out his career in his own way, as others will continue to do in this business—if it is in them.

Walker was born in Chicago. His father died when he was ten and two years later he went to live on an Indiana farm. At seventeen he decided to

go back to the Big Town and get an education. For six years he worked nights—which is a lot of nights—five as oiler in one of the power plants and one year in a substation for the Commonwealth Edison Co. Meanwhile, he took special courses at Lewis Institute. Then he got transferred to the engineering department. That was thirty one years ago. And the day he walked in to take his new job, under E. O. Schweitzer, now of Schweitzer & Conrad, another youngster was just starting too. It was K. D. White.

Four years later, Ralph stepped out. He joined the old Buckeye Lamp Works under "Sorry" Sawyer. White followed him a year later. One day Walker came in with an order from the Chicago Street Railway for several thousand tantalum lamps. And did that start ructions! This street railway was the customer of another division of the National Lamp Association. But Ralph saw a chance and walked in. He was called to Cleveland to the main carpet. When the dust settled, however, the fact remained that Walker was pulling down orders that nobody else seemed to reach. And that was that.

But for some time, Walker had carried a bee in his bonnet that wouldn't



chance opened up nearby in Columbus. Ralph wigwagged to K. D. and White jumped down and started a branch of the Walker Electric & Plumbing Company there.

So Ralph was now in business up to his ears. He liked industrial construction best and this kept calling him to Atlanta, where most manufacturer's main offices were located. Therefore, in 1916, he moved his headquarters there, but still operated in Rome and Columbus, wiring, plumbing and industrial construction. Also, because he could not get sheet metal equipment for the factory expansions that kept him jumping during the war, he bought some machinery and started making his own boxes.

But in 1923, business hit the toboggan. Walker had hard sledding. In 1924, he bought out his brother-in-law and liquidated the plumbing business. Later he closed up in Rome. But White continued in Columbus, where he had built up a good industrial contracting

the real one. Construction stopped and soon that sheet metal shop came in handy. They expanded this manufacturing business and made a larger variety of boxes for meters, junctions, panels. "Ralph worked awful hard," K. D. says, but the volume grew. They have outgrown their plant twice and now employ a hundred men, in the manufacturing department, three shifts. They have recently bought land in Atlanta and are about to build a modern plant to house both the manufacturing and construction business. They sell the boxes exclusively through jobbers, and ship plumb to the Coast and north to Boston. Ralph handles this end himself. It is his baby.

But that does not mean that Walker is not a contractor, too. Construction is his real job. They have an engineering department, a construction superintendent and ten job superintendents, a purchasing agent and assistant and a clerical staff. He is well organized and moves fast.

THE GLANZSTOFF JOB—(left) Here's what you get—if you're good—when you specialize in textile mills. One of the two big rayon mills at Elizabethton, Tenn.

ONE OF WALKER'S GANGS—(below) This time they were working at the Riverside and Dan River Mills, Danville, Virginia, a million dollar job, the largest installation of individual loom motors in the world.

quit buzzing. Everybody was wiring up then. The South appealed to him. An old Edison associate, Raymond P. Reeves, had gone down to Selma, Alabama, and bought out an electrical contracting business. He had been writing Ralph to come down, and gradually Ralph got to thinking if he could get business for Buckeye, why not for himself? So he quit the lamp game, went down to Selma on a visit, and bought an interest in Reeves' company. Then he jumped back to Chicago and got married; and with this perfect combination of inspiration and opportunity, he returned to Selma—a contractor.

Inside of a year, Walker discovered that the Selma business was too small for two. He decided to strike out on his own and looked over several places in Illinois and Indiana. Finally, he picked Rome, Ga., where he bought out the wiring department of the Rome Railway and Light Company. Ralph secured a lot of business that the power company had not been able to land by itself. They were delighted with the load, he with his profit on the wiring. He had an ideal cooperative set up.

A little later, he got his brother-in-law to come and they launched a plumbing business also. Then next fall, a



business and incidentally a motor repair shop, doing a nice job.

They specialized now in textile mill work, all over the Southeast, from Louisville to Shreveport to Washington. In 1929 and 30, they did the great American Glanzstoff rayon job at Elizabethton, Tenn. They did the Enka rayon plant at Asheville, N. C., and the Chatillon works, at Rome, and the whopping Goodyear Tire and Rubber development at Gadsden, Ala. And it paid.

Then they hit the other toboggan—

Last September Fisher Body decided to re-tool their Atlanta works, for a new Chevrolet model. It entailed a lot of electrical work. Walker heard the news, got the plans at noon one day, jumped a plane for Detroit and had a bid in at 10 o'clock next morning. He landed the job, rounded up 125 men over Sunday, had two weeks to do the work and finished it twelve hours ahead of schedule—a \$90,000 job. Some going!

On these jobs, they locate a super-

[Continued on Page 111]

Conduit Sizes for Signal Work

CONDUITS used in low-tension signaling and telephone systems are frequently found inadequate in capacity. This is usually due to lack of consideration in laying out the system, before installing the conduits. But the many difficulties encountered in such systems may be reduced to a minimum, by providing conduits of sufficient size to amply take care of the circuit wiring requirements. In addition, some spare wires should be included, ready for possible future trouble.

Conduits for low-tension systems should be installed with the same care as in light and power wiring. They should be sufficiently large, so that it will be unnecessary to use much force to pull in the wires, with risks of injuring the insulation, or sometimes even breaking the conductors themselves. Also, the wires should never be permitted to become wedged, so that they cannot be withdrawn if the need arises.

The proportion of the cross-sectional area of the inside of the conduit, in relation to the conductors to be drawn into it, has now been established by the "National Electrical Code." The code states:

"The number of wires in any conduit or other raceway need not be limited, except that the combined cross-sectional area of all conductors shall not exceed 40 per cent of the cross-sectional area of the conduit or raceway".

Presenting a Set of Tables Showing The Size of Conduit Required for Low Tension Circuits

By Albert A. Schuhler

This rule has been found very satisfactory in practice. To clarify this rule further, it means that not more than 40 per cent of the interior cross-sectional area of the conduit may be used for the wire, while 60 per cent remains for space to insure easy handling of the conductors and cables.

The code also provides for a minimum of No. 18 B & S gauge wire on low-tension systems, to be rubber covered with not less than $\frac{1}{16}$ " rubber insulation. In practice No. 16 wire should be the smallest used, and this size wire must also have $\frac{1}{16}$ " rubber insulation. Larger conductors require the usual $\frac{1}{8}$ " rubber insulation.

The cables used in telephone systems have the usual silk and cotton insulation, over the bare conductors, with either a braided or leaded outer covering. The conductors in these cables provide No. 22 B & S gauge wire, for the section wires, and No. 18 wire for the current supply or feeder wires. The duplex and triplex twisted wires, for telephone work, have No. 19 wires.

The use of elbows is held down

to a minimum, in low-tension conduit systems. Pull and terminal boxes are being used to a large extent. These points are provided with terminal strips, and in this way splices are eliminated. In addition, feeders and branch circuits may be readily connected or disconnected or tested, if necessary.

The accompanying tables cover the types of wires and cables, used in low-tension signaling and telephone systems. The 40 per cent rule, as provided by the code, has been followed throughout. The tables giving cable, duplex and triplex wire data show overall diameters in addition to the conduit sizes.

Data on signal system cables is shown in Table 1. Column 1 indicates the number of conductors, which will satisfactorily fit in the various sizes of conduits listed in columns 3, 5, 7, 9, 12, 15, 18 and 21. The size of wire, including the thickness of rubber insulation and type of wire—braided or leaded—is shown at the head of the columns. It will be noted that No. 18 and No. 16 braided and leaded cable,

TABLE 1—SIGNAL SYSTEM CABLES

No. Cond.	No. 18-1/64" R. B.*		No. 18-1/32" R. B.		No. 16-1/64" R. B.*		No. 16-1/32" R. B.		No. 18-1/64" R. L.			No. 18-1/32" R. L.			No. 16-1/64" R. L.			No. 16-1/32" R. L.		
	Over. Diam.	Conduit Size	Over. Diam.	Conduit Size	Over. Diam.	Conduit Size	Over. Diam.	Conduit Size	Over. Diam.	Thick Lead	Conduit Size	Over. Diam.	Thick Lead	Conduit Size	Over. Diam.	Thick Lead	Conduit Size	Over. Diam.	Thick Lead	Conduit Size
10	0.49	3/4"	0.61	1"	0.53	1"	0.65	1"	0.56	4/64"	1"	0.69	4/64"	1 1/8"	0.61	4/64"	1"	0.73	4/64"	1 1/8"
20	0.63	1"	0.80	1 1/4"	0.69	1 1/4"	0.85	1 1/4"	0.70	4/64"	1 1/4"	0.90	5/64"	1 1/2"	0.76	4/64"	1 1/4"	0.96	5/64"	1 1/2"
30	0.74	1 1/8"	0.94	1 3/4"	0.81	1 3/4"	1.01	1 3/4"	0.82	4/64"	1 1/8"	0.95	5/64"	1 3/4"	0.82	5/64"	1 1/4"	1.12	5/64"	1 3/4"
40	0.83	1 1/2"	1.06	2"	0.92	1 1/2"	1.14	2"	0.94	5/64"	1 1/2"	1.17	5/64"	2"	1.02	5/64"	2"	1.28	6/64"	2"
50	0.93	1 3/4"	1.18	2 1/4"	1.02	1 3/4"	1.27	2 1/4"	1.03	5/64"	1 3/4"	1.32	6/64"	2 1/4"	1.12	5/64"	2"	1.41	6/64"	2 1/4"
60	1.00	2"	1.28	2 3/4"	1.10	2"	1.38	2 3/4"	1.10	5/64"	2"	1.41	6/64"	2 1/2"	1.20	5/64"	2"	1.51	6/64"	2 1/2"
70	1.10	2 1/4"	1.41	3"	1.21	2 1/4"	1.53	2 3/4"	1.21	5/64"	2 1/4"	1.55	6/64"	2 3/4"	1.35	6/64"	2 1/2"	1.66	6/64"	3"
80	1.15	2 1/2"	1.48	3 1/4"	1.27	2 1/2"	1.60	3"	1.29	6/64"	2 1/2"	1.61	6/64"	3"	1.40	6/64"	2 1/2"	1.76	7/64"	3 1/4"
90	1.21	2 3/4"	1.54	3 1/2"	1.32	2 3/4"	1.67	3 1/4"	1.35	6/64"	2 3/4"	1.68	6/64"	3 1/4"	1.46	6/64"	2 3/4"	1.83	7/64"	3 1/2"
100	1.28	3"	1.66	3 3/4"	1.41	3"	1.79	3 1/2"	1.42	6/64"	2 3/4"	1.82	7/64"	3 1/2"	1.55	6/64"	2 3/4"	1.95	7/64"	3 3/4"
125	1.40	3 1/2"	1.82	4"	1.56	3 1/2"	1.96	3 3/4"	1.54	6/64"	2 3/4"	1.98	7/64"	3 3/4"	1.69	6/64"	3"	2.12	7/64"	3 3/4"
150	1.54	3 3/4"	1.99	4 1/4"	1.70	3 3/4"	2.15	3 3/2"	1.68	6/64"	3"	2.15	7/64"	3 3/4"	1.86	7/64"	3 1/2"	2.34	8/64"	4"
175	1.66	4"	2.14	4 1/2"	1.83	4"	2.31	4"	1.82	7/64"	3 1/4"	2.33	8/64"	4"	1.99	7/64"	3 1/2"	2.50	8/64"	4 1/4"
200	1.77	4 1/4"	2.28	4 3/4"	1.95	3 3/2"	2.47	4 1/4"	1.93	7/64"	3 3/4"	2.47	8/64"	4 1/4"	2.11	7/64"	3 3/2"	2.66	8/64"	4 1/2"

* Approved by special permission only.

TABLE 2—PAGING SYSTEM CABLES

No. Cond.	No. 14-3/8" RB		No. 12-3/8" RB		No. 14-3/8" R.L.			No. 12-3/8" R.L.		
	Over. Diam.	Conduit Size	Over. Diam.	Conduit Size	Over. Diam.	Thick. Lead	Conduit Size	Over. Diam.	Thick. Lead	Conduit Size
12	0.84	1 1/2"	0.94	1 1/2"	0.97	3/8"	1 1/2"	1.05	3/8"	2"
20	1.10	2"	1.19	2"	1.20	3/8"	2"	1.32	3/8"	2 1/2"
24	1.21	2"	1.31	2"	1.35	3/8"	2 1/2"	1.45	3/8"	2 3/4"

having $\frac{1}{16}$ " rubber, is subject to the approval of the local inspector.

Table 2 includes the type of cable generally used in connection with silent or lamp type paging systems. These cables may also be used for other purposes, especially signal systems having long runs.

Grouped single conductor data is shown in Table 3. Wiring that uses

TABLE 3—GROUPED SINGLE CONDUCTORS

No. Cond.	No. 18 [*] 1/4" RB	No. 18 1/4" RB	No. 16 [*] 3/8" RB	No. 16 3/8" RB	No. 14 [*] 1/2" RB	No. 12 [*] 5/8" RB	No. 10 [*] 3/4" RB
	Conduit Size	Conduit Size	Conduit Size	Conduit Size	Conduit Size	Conduit Size	Conduit Size
5	1/4"	1/4"	1/4"	1/4"	3/8"	3/8"	1"
10	1/4"	1/4"	1/4"	1/4"	1"	1 1/4"	1 1/4"
11	1/4"	1/4"	1/4"	1/4"	1"	1 1/4"	1 1/4"
12	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
15	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
16	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
20	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
24	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
25	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
30	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
35	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
40	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
45	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
50	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
55	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
60	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
65	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
70	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
75	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
80	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
85	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
90	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
95	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"
100	1/4"	1/4"	1/4"	1/4"	1 1/4"	1 1/4"	1 1/4"

* Approved by special permission only.

TABLE 4—DUPLEX & TRIPLEX

No. Cond.	No. 19-1/2" RB *		No. 19-1/2" RB **	
	Over. Diam.	Conduit Size	Over. Diam.	Conduit Size
2	0.24	1/4"	0.26	3/8"
3	0.41	3/8"	0.47	3/4"
4	0.47	3/8"	0.56	1"
6	0.50	3/8"	0.63	1 1/4"
8	0.60	1"	0.67	1 1/4"
10	0.63	1 1/4"	0.75	1 1/4"
12	0.66	1 1/4"	0.81	1 1/4"
14	0.69	1 1/4"	0.88	1 1/4"
15	0.75	1 1/4"	0.91	1 1/4"
16	0.78	1 1/4"	0.94	1 1/4"
18	0.84	1 1/4"	0.97	1 1/4"
20	0.88	1 1/4"	1.00	1 1/4"
21	0.90	1 1/4"	1.03	1 1/4"
22	0.94	1 1/4"	1.06	1 1/4"
24	0.97	1 1/4"	1.09	1 1/4"
26	1.00	1 1/4"	1.13	1 1/4"
27	1.03	1 1/4"	1.16	1 1/4"
28	1.06	1 1/4"	1.19	1 1/4"
30	1.09	1 1/4"	1.22	1 1/4"
32	1.13	1 1/4"	1.25	1 1/4"
33	1.16	1 1/4"	1.28	1 1/4"
34	1.19	1 1/4"	1.31	1 1/4"
36	1.22	1 1/4"	1.34	1 1/4"
38	1.25	1 1/4"	1.37	1 1/4"
39	1.28	1 1/4"	1.40	1 1/4"
40	1.31	1 1/4"	1.43	1 1/4"

* 2 Conductor. ** 3 Conductor.

individual conductors is most frequently employed at the present time, although in many cases this method is being superseded by multiple conductor cables. Wherever a number of single conductors are used in a system, it is recommended that colored braided wires be used. Columns 2 and 4 are subject to approval by the local inspector.

Duplex and triplex, twisted, rubber insulated conductors are covered in Table 4. These wires are used exclusively in telephone work. Columns 2 and 3 include data on the duplex or two-conductor wires, while columns 4 and 5 cover data on the triplex or three-conductor wires.

Table 5 includes data on two types of telephone cables. One type is composed of a specified number of No. 22, B & S gauge wires, made up into pairs, with 2 pairs of No. 18 B & S gauge wire. This type of cable is designed for use in connection with intercommunicating telephone systems, where No. 22 wire is used for section wires, while the No. 18 wires are used for the current supply wires or feeders. The second type is composed of a specified number of pairs of No. 22 wires only. This type of cable is designed for use with telephone switchboard systems. In switchboard systems using a common wire, one or more of the pairs of wires may be twisted together at the terminals, to provide greater conductivity; or a separate larger single conductor may be pulled into the conduit with the cable. No. 18 wires, mentioned in the first type of cable, may

also be used as a common wire. While this table has taken care of all wires in a cable, column 1 is based upon the number of section wires required in a system.

Table 6 includes the single conductor type of telephone cable. This cable is composed of single No. 22 B & S gauge wires, as required for a system, and also 4 single No. 18 wires. This cable is used in connection with intercommunicating telephone systems, both of the common return type of selective ringing-selective talking system and the selective ringing-common talking system. The No. 22 wires are used for the section wires, while the No. 18 wires are used for the current supply or feeder wires.

TABLE 5—PAIR TELEPHONE CABLE

No. Pairs	Braided *		Leaded *		Braided **		Leaded **	
	Over. Diam.	Conduit Size	Over. Diam.	Conduit Size	Over. Diam.	Conduit Size	Over. Diam.	Conduit Size
6	0.36	1/4"	0.45	3/8"	0.29	1/4"	0.33	1/4"
12	0.41	3/8"	0.50	3/4"	0.38	1/2"	0.42	3/4"
16	0.50	3/4"	0.59	1"	0.42	3/4"	0.47	3/4"
22	0.57	1"	0.66	1 1/4"	0.49	3/4"	0.53	1"
32	0.62	1 1/4"	0.71	1 1/2"	0.57	1"	0.61	1 1/4"
41	0.74	1 1/2"	0.85	1 3/4"	0.61	1 1/4"	0.66	1 1/4"
51	0.88	1 3/4"	0.97	2"	0.70	1 1/2"	0.76	1 1/2"
65	0.92	1 3/4"	1.01	2 1/4"	0.76	1 3/4"	0.83	1 3/4"
75	0.95	1 3/4"	1.03	2 1/2"	0.82	1 3/4"	0.89	1 3/4"
85	0.98	1 3/4"	1.07	2 3/4"	0.86	1 3/4"	0.93	1 3/4"
100	1.08	2"	1.16	2 3/4"	0.94	1 3/4"	1.01	1 3/4"
125	1.18	2 1/4"	1.26	3"	1.01	1 3/4"	1.08	2"
150	1.27	2 1/2"	1.34	3 1/4"	1.12	2"	1.18	2 1/4"
175	1.37	2 3/4"	1.44	3 3/4"	1.18	2 1/4"	1.25	2 1/2"
200	1.45	3"	1.57	4"	1.27	2 1/2"	1.34	2 3/4"

* No. Pairs #22 & 2 Pairs #18.

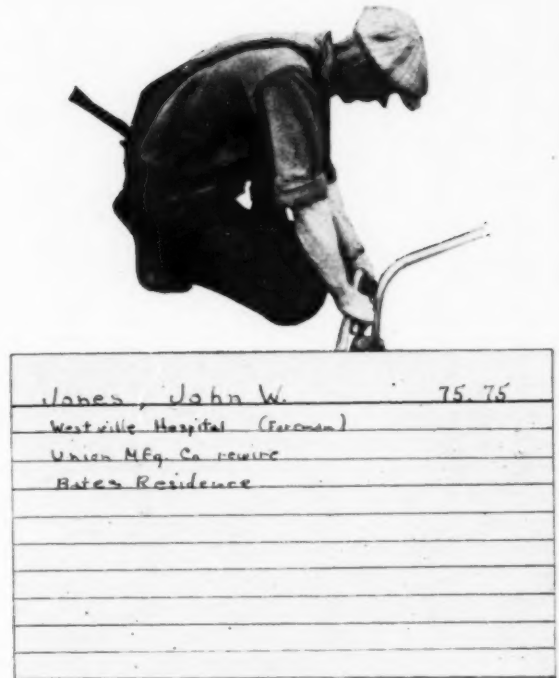
** No. Pairs #22 Only.

TABLE 6—SINGLE TELEPHONE CABLE

No. Cond.	Braided *		Leaded *	
	Over. Diam.	Conduit Size	Over. Diam.	Conduit Size
6	0.26	1/4"	0.30	1/4"
11	0.28	1/4"	0.33	1/4"
16	0.31	1/4"	0.36	1/4"
26	0.36	1/4"	0.40	1/4"
35	0.40	1/4"	0.45	1/4"
45	0.44	1/4"	0.48	1/4"
55	0.46	1/4"	0.51	1/4"
65	0.51	1/4"	0.55	1/4"
75	0.53	1/4"	0.57	1/4"
85	0.55	1/4"	0.60	1/4"
100	0.60	1/4"	0.64	1/4"

* No. Single #22 & 4 Single #18.

How Good Are Y



By William T. Stuart

Middle West Editor, Electrical Contracting

MANY contractors have faced the problem of rebuilding their organizations during the past two years. A growing demand for skilled men and a shortage of good mechanics has made the job difficult.

Competition is still keen. Progress schedules are being stepped up. Quick and accurate planning and job coordination are more than ever essential. The estimator must have exact knowledge of the abilities of the men, who will be placed on the job. It is the superintendent's job to set up a permanent basic crew of good men and on his success depends the future of his company.

Selecting these men is not a matter for snap judgments. Friendship, ingratiation, personality, politics, lodge association, union rules will all confuse and attempt to obscure the main issue of getting responsible, loyal men of known ability. The only sound policy is to be scrupulously fair to the men, but any method adopted is going to leave some sore spots in the shop.

A classification system of some sort, is needed and it must face the issue realistically. The skill and ability of different men vary widely in different classes of work. The requirements of

various kinds of jobs also indicate a need for different qualifications among the men. In addition, two factors must be kept in mind. The office is not justified in keeping a very elaborate checking system. Any arbitrary classification of men is accurate only within wide limits. However, though 100 per cent accuracy and reliability is not possible, any classification system that is 75 per cent accurate is much better than no system at all.

Three vital characteristics must be included in the classification system—

1. Job handling ability comes first. Is the man able to run a good sized job? Can he handle a gang of men smoothly and efficiently? Is he resourceful? Does he cooperate with the other trades on the job?

There is no method for obtaining this information except by careful observation. The superintendent can draw on his experience with men and arrive at a close approximation. Then using a scale—reading from 1, meaning no ability—to 9 or 10, representing unusual executive capacity—a fairly close figure may be put down to cover this classification. Take John Jones, for example, twelve years a journeyman,

excellent executive ability, resourceful, but not so good at getting along with the other trades. We would classify him 9 for executive capacity, 8 for his resourcefulness, 4 for cooperation. We add them together and average and we get his job handling score of 7.

2. Personality is next in importance in the classification. Where industrial work is handled, where customers are contacted in their homes, the personality of the mechanic can make or break the sales program of the office. This again is a matter for observation. John Jones is just average in this classification. We shall set down the number 5 behind the 7. His card now reads 75.

3. Speed is the last factor to be set up. Here we can apply a strictly objective method. John Jones is sent out on a small job. The list of materials at the finish of the job is recorded and priced for labor, according to any standard estimating system. With all the conditions known, special job factors can be very accurately applied. The job figures 48 hours. Jones' time sheet reads 36 hours, giving a speed factor of .75, a very fast rate. We now have a complete picture of John

Your MEN?



Robinson, James S.	49.78
Maintenance Contract - Field Co.	
Harcourt School	
12th St. Warehouse	
College Dormitory	

A Simple System for Analyzing the Capabilities of Your Men to Aid in Selecting Them for the Job

Jones. His card reads 75:75. Bill Smith has also been put through the mill and come out with 98:90, and Jim Robinson scores 49:78.

The estimator has an industrial job on the board. He calls in the superintendent.

"Who can we put on this?" he asks. "There are a lot of extras that must be taken care of and we are in a preferred position to get the job."

A quick analysis of the above figures points out at once that Bill Smith is the man and Jim Robinson should also be slated to work that job. Bill is not as fast but a top foreman and a first rate salesman. Jim will make up in speed where Bill leaves off and will also keep the customer on friendly terms. A quick calculation gives the estimator the speed he may expect from the crew selected. Costs are known, the men have been selected by a fair, objective method and the superintendent has the data qualifying his selection at hand in a permanent form.

Such a classification system, of course, is a private matter. Data should be available to only those who have a vital concern with it. While the superintendent may discuss such data in a statistical manner with the men as a group, individual scores should be discussed only with the man concerned. Like any other personal problem, the superintendent must keep in mind that he is dealing with people, that Jones is much more concerned with the new baby's colic than the copper index. His score will be a matter of vital importance to him and he will resent any casual treatment of it.

Judiciously handled, such a classification system can be a powerful incentive to the men. Carelessly treated, it may have precisely the opposite effect. This is the superintendent's problem. Does it work? It does. Such a system is already in use in several shops in the East and has produced very excellent results.

CLASSIFICATION

A number is developed for each man according to his ability and qualifications

1—Foreman Qualifications

- A Executive ability
- B Resourcefulness
- C Cooperation with other trades

SCORE 1 TO 9

2—Personality

- A Customer contacts
- B Salesmanship
- C Loyalty to company

SCORE 1 TO 9

3—Speed Factor

Score by dividing actual time by estimated time for a test job.



With Salt
for his Tail

The Fable Of the Alert Young Contractor Who Loves Robins



Visits Shiny
New House

ONCE upon a time, a Bright Young Contractor walked out one Salubrious Saturday Afternoon to count the Nice Fat Robins and see if he could Call It Spring. He lives in one of the Hei-De-Ho Overnight Suburbs not far from Mad Manhattan.

Now this particular Perambulating Contractor is smart—and alert—no end. He is always trying to Figger Out some way to turn something Upside Down electrically—or maybe Set it Straight. Oh, yes—his mind is always on His Business. So when he came along to a Shiny Block of Bran New Houses, he told the Fat Robins to wait and took a look.

Well, this row of Shiny Houses is the Last Word—if not Later. They Delight the Eye. They Satisfy the Soul. They Lull the Pocket Nerve. They get 'emselves sold. They are complete with Self Lubricating Cellar Stairs, and Overhanging Mortgages. So the Alert Young Contractor was well pleased, as he walked around with the Real Estater's Dapper Salesman. He wished he had brought The Wife along—and then thought maybe it was just as well.

Anyway, he went upstairs. This Shiny House was designed on the Pistachio Motif—to sell for 16,000 Iron Men. It had a little Sewing Room—oh, so cute!—with a Convenient Closet 'n everything. He looked around. There was a Nice Little Light in the center of the ceiling. So with a Passionate Zeal for the Welfare of his Industry burning ever in his breast, he asked a question—

"Where will they Connect Up the Sewing Machine?" sezzee.

"Why—er—" said the Hospitable Building Boomer, looking hurriedly around. "Why—er—Why you just String a Cord in from the next room, you know, through the hall. It's Simple Enough!"

"Is zat so!" exclaimed our Hero. "Is zat so! Now let me Tell You Something young feller—" and he was

off. He dragged the Poor Guy around and showed him that—

1. There was no outlet for nooking in the Breakfast Nook
2. The Dining Room had only one duplex receptacle.
3. So did the three Bed Rooms—Tut-Tut!
4. The Living Room had only three.
5. But in the Whoopee Cellar, there was one ceiling light and no place to Toast a Truffle or Mix the Grog—Eemagine it!

Well, the Alert Young Contractor made this all clear and proved that Outlets Sell Homes. But the Real Estater was really limp and wobbly and explained that it Wasn't his House Anyway. He was Just On Commission—and not much come. So Young Tom Edison—Our Hero, you know—he walked out. And the Fat Robins had all Wangled their Worms and gone.

And the Funny Part is—and now we're leading toward our Practical Purpose—or is it funny?—that the Electrical Contractors in that town, right then were Holding Meetings and Making Plans to get a local ordinance passed that would just about put their Small Competitors out of business. They wanted More Volume and they couldn't think of any better way to get it.

And the answer to that is—Ho-Hum!

And the Moral is—Get after the Real Estaters with a Little Salt and forget the Fat Robins.

***Believe it or not, Mr. Ripley, it Really Happened, just that way, and there were Fat Robins in town.



Real Estater
Getting Limp

Contractors Thinking



Electrical Contracting, July 1937



They keep pace with each other— *All the way up!*

The modern home is the electrical home—from basement to attic. Electrical equipment sales therefore must keep pace with home-building and home-modernization. So, in this greatest-of-all-time housing boom which is beginning to "break" on every side, electrical household equipment men face their greatest-of-all-time opportunity.

It is a quality market. Sales are concentrating on the electrical equipment which brings new comforts, conveniences and luxuries of living. Wise merchandisers who have found their place in this market and intend to keep it know that every dependable electrical installation starts with Cutler-Hammer Meter and Service Entrance Equipment. CUTLER-HAMMER, Inc., Pioneer Manufacturers of Electric Control Apparatus, 1306 St. Paul Ave., Milwaukee, Wis.



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are built to make installation easier (for example, the one-screw demounting removable interior, the solderless connectors permitting use of screw-driver or socket wrench, the ample wiring space, the plentiful knockouts, the easy-to-wire terminals),
to save service calls (for example, the non-interchangeable main and range switch pull-outs, the solid porcelain barriers between terminals),

to simplify periodic inspection (for example, the non-service-interrupting fuse test holes).

Bul. 4334H15 is available with 60 amp. main and range switches; 4 branch circuits; 60 amp. tap for extra distribution panel or water heater.



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Each new day brings wider recognition of Safecote performance and Safecote dependability. Evidence of the growing confidence in this product, the performance standards of which are so rigidly guarded, is the fact that *approximately 90% of all building wire is Safecote.*

There is no substitute for Safecote. There is no substitute for Safecote performance and Safecote dependability resulting from and guarded by these standards:—

substitute for Confidence

ELECTRICAL

CONDUCTORS



U. S. LETTERS PATENT NUMBERS:
1,635,829 1,772,436 1,765,000
1,798,486 1,410,790 1,536,549

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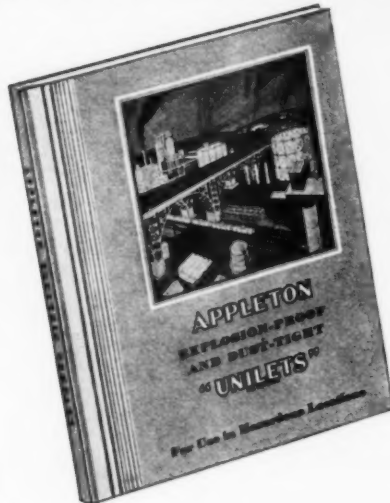
NEW BULLETIN

ON EXPLOSION-PROOF AND DUST-TIGHT UNILETS

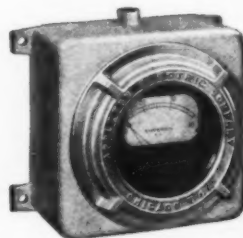
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These Unilets are sturdily constructed of malleable iron for strength and durability. Cadmium coating makes them resistant to rust and corrosion. They are built to last a lifetime.

New Bulletin Just Out

Appleton Bulletin No. 1004 is just off the press and it is filled with valuable information on wiring in hazardous locations. Write today for Bulletin No. 1004—"Appleton Explosion-Proof and Dust-Tight Unilets." There is no charge and no obligation.

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Explosion Proof Wiring

Explosion Hazards in Industry

By W. M. Runyon

*Hazardous Location Specialist,
Crouse-Hinds Company*

Spectacular growth in chemical industries and universal adoption of chemical processes by other manufacturers have filled America's industrial plants with explosion and fire hazards—Explosion proof electrical systems now required in these dangerous locations—A challenge to the electrical contractor—and an opportunity.

WAR caught the United States woefully backward in chemical knowledge and products in 1917. But the aroused nation called on its technical brains to perform a miracle and they did. Out of the war time came a new American industry. Research and development has continued and the chemical industry of the U. S. now stands in the first rank. Not only have we built up an enormous production of chemicals in this country. We are building a new world, by the synthetic creation of substitutes for wood, leather, cloth, metals and a wide assortment of other commonly used materials, that are growing steadily in demand and application. As a result, we find chemical processes now employed to some extent in almost every industry.

Many chemicals are hot tempered. They create fumes that mix with the air and are highly explosive. They produce dust laden atmospheres that are dangerously inflammable. Both in the manufacture of these chemicals themselves, in their use in other plants, the presence of these gases and dusts have created serious hazards to life and property. But because they are so new, they are

often not recognized, or their importance is not appreciated, and many disastrous accidents follow.

One of the most common of these new hazards comes from the paint spray. We see it everywhere in industry. In the old days, it took thirty days to completely paint an automobile. Today a car is given one coat in six to ten seconds, dried in two to four hours, and is

completely finished in two to four days. This is possible because the chemist has developed quick drying paint. It dries quickly because the solvent in it evaporates quickly—and the carbon black, powdered coal, sulphur, wood flour and metals used for paint bases in dust form mix with the air—and at a certain point, the mixture becomes explosive. That is where danger lurks.

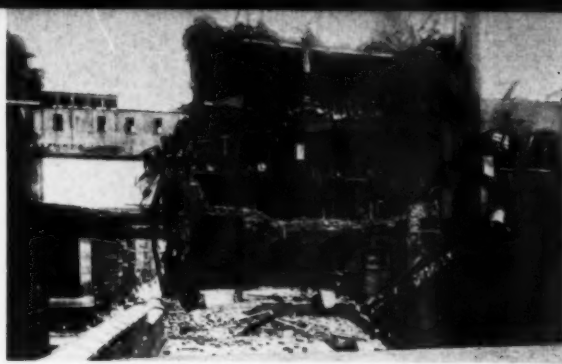
STARCH DID THIS—Ruins of an Iowa starch plant after the explosion of a dustladen atmosphere. It cost forty-three lives that should have been saved.



These explosion pictures were furnished by U.S. Dept of Agriculture.



SPICE DID THIS—Dust exploded here in a spice grinding plant one winter day and four men were killed.



SUGAR DID THIS—A Brooklyn sugar refinery blew up one day with this result—and twelve men were dead.

To prevent explosions, ventilation alone is not adequate. Ignition of the fumes must also be prevented.

Likewise, the increased use of grain products in the food industry has produced many new dust-cloud hazards. The present use of high speed production machinery, in the textile and allied industries, produces linters, flyings and fibres. If ignited, these substances cause violent flash fires. Also, the storage and warehousing of fibre products causes linters that produce flash fires. So industry today also is deeply concerned with the protection of these hazardous locations against sparks and high temperatures.

Serious Losses

Electricity is, of course, indispensable in these new and modern industries, because of its adaptability for remote control and automatic regulation. But, where not safeguarded, there is an ever present menace in the operating arcs, that are caused by the making and breaking of circuits. It offers a dangerous source of ignition in the presence of air-fumes, dust-clouds, and linters.

Up to 1928, the installation of standard electrical equipment in hazardous locations was permitted by the National Electrical Code. There were many fatal accidents, however, and large losses in life and property that were clearly attributable to the use of improperly designed electrical equipment. More than two hundred lives were lost in two explosions alone. Here are a few actual cases—

1. In an automobile body manufacturing plant, a spray paint explosion took over 100 lives.
2. In a hospital clinic, an X-Ray film decomposition and explosion cost over 100 lives.
3. Several furniture factories suffered disastrous spray paint losses.
4. A shoe manufacturing plant, using nitrocellulose, lost 13 lives.
5. A chemical plant solvent explosion took several lives.

6. A distillery warehouse structure containing alcohol was destroyed to a value of \$2,500,000.

7. Several soybean plant explosions resulted in eleven killed and property loss of \$750,000.

8. Several paint and varnish plant explosions produced losses of \$250,000 to \$500,000 each, killing and injuring several workmen.

9. Several wood flour mills blew up, most of them totally destroyed.

10. Several grain elevators and flour mills had dust explosions, that cost 33 lives and property losses running from \$100,000 to \$3,750,000 each.

11. An aluminum powder disaster, killed five persons and cost \$100,000.

12. Gasoline station pits have caused many explosions, that have taken the attendant's life.

13. Rubber cement industry has suffered numerous explosions, with life and fire losses.

These recurring life, accident and property losses actually plunged some of the larger insurance companies into red ink for a considerable period, and they naturally demanded relief. The electrical industry also decided to put its house in order, so that ignition in such hazardous areas could no longer

be charged to it. Therefore, the National Fire Protection Association, as sponsors for the National Electrical Code, appointed a Special Manufacturers Hazardous Risk Committee to survey such industries. On this committee were trained men drawn from the affected industries. Their recommendations were accepted by the Electrical Committee and became a part of Article 32, of the 1928 edition of the National Electrical Code. These code requirements were exacting. They required the use of explosion-proof and dust-tight equipment in all hazardous areas.

Problem Met

To the electrical manufacturing industry these new rules called for an immediate program of product development. It meant chemical research with gas, dust and linters, experiments with explosions and fires, design and testing of materials. Beyond that were the many problems of marketing and trade education, in order that their part of the job be carried through to completion. For these code requirements entailed the creation of an entirely new line of apparatus, built from the bottom up.

Today enforcement of Article 32 is nation-wide. The demand has grown so rapidly that approximately 20 per cent of the volume of fitting sales are now hazardous location apparatus. Since 1932, the large, high grade industries have used explosion proof equipment to the full extent. They have even demanded a further development to keep up with their complex installations. Many progressive small companies have taken the same course, because they sleep sounder when approved equipment is in service.

But the many small industrials have quite naturally been backward in meeting these new code standards. It is here that the inspectors are forced to take a firm stand and demand approved installations of hazardous location equipment. It is here, also, that the electrical contractor carries a heavy responsibility, if he installs equipment that is not designed for such hazards.

WOOD DID THIS—Dust lets go in woodworking plants and fire follows. Here in Buffalo, the loss was \$75,000.



The Code Shows the Way

SINCE 1928, the National Electrical Code has contained a set of definite requirements for wiring and electrical equipment, used in hazardous locations. These rules were assembled under Article 32, for the guidance of installers and inspectors of electrical work in various kinds of hazardous areas.

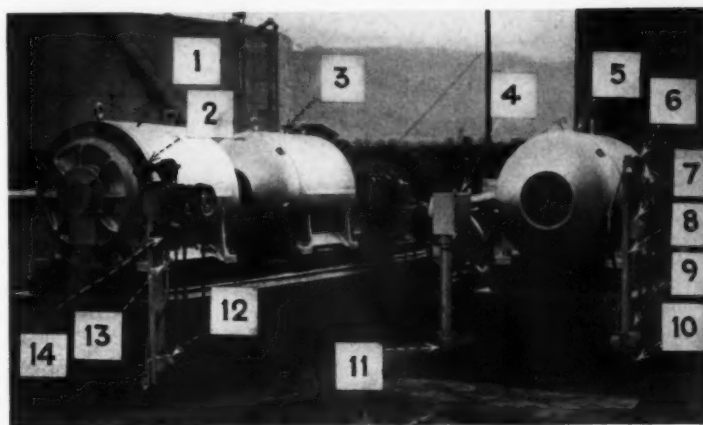
The code recognizes the fact that certain chemicals, fibres and dusts, encountered in industrial buildings, can become dangerous in the presence of flame, electrical arcs or sparks, or excessive temperatures. When installed within or near these hazardous areas, the raceways of electrical systems and the enclosures for over-current units, devices, controllers and other equipment are subject to certain explosion producing hazards. Some of these hazards are related to the physical makeup of the equipment itself. Others are caused by the actual functions of the equipment. Still other hazards are provoked by chemical and organic processes in the industry involved.

All these explosion hazards are classified under the code in four groups. Class I. hazards embrace air-fume combinations. Class II. covers dust laden atmospheres. Class III. includes inflammable linters and fibres. Class IV. deals with these hazardous chemicals and fibres, when in storage.

Under Class I., four principal objectives are sought in the code as a protection from fume hazards—

1. *Prevention of breathing in metal systems.* Breathing is due largely to the heating and cooling that takes place in metal systems and equipment cases due to the starting and stopping of electrical equipment. As a result, the air inside those units expands and contracts, alternately spilling out air and sucking in air from the surrounding area. Conduits installed between rooms or locations, having considerable differences in temperature, also breathe. Fume-laden atmospheres of an explosive nature thus circulate through conduits into enclosures that house arc-producing devices. A complete cycle of breathing usually takes place in from two to twelve hours.

2. *Prevention of the ignition of explosive gases from electrical sources,* by the operation of controls, devices, static electricity, grounds, short circuits, overheating and other causes.



OIL PUMPS for a California pipe line. Fourteen gas explosion safeguards are visible in this picture, located at danger points.

3. *Determination of the percentages of air mixture with explosive gases, that produce combustion.* This involves many chemical characteristics. Gasoline has a rich mixture at $1\frac{1}{4}$ per cent, for instance.

4. *Prevention of combustible mixtures within the electrical system.* Combustion takes place when rich mixtures of explosive gases are breathed into conduits or enclosures and become ignited. This combustion develops high pressures, within the fittings and enclosures that comprise the system. Only explosion proof, Class I, equipment will stand these pressures and confine the combustion arc within the enclosures, and prevent flame from escaping and igniting the surrounding area.

In dealing with Class II. hazards, the code recognizes that, if ignited, a dust cloud will cause an explosion. Therefore, the code requires that:

1. Dust must not enter equipment, as some dusts are conductive and will cause short circuits.

2. Dust tight apparatus must be so designed that dust cannot cause a blanketing effect and store up heat and cause ignition.

Dust explosions from electrical causes follow a regular cycle of four steps—

1. The dust-air mixture is ignited by an arc, spark, hot wire, or overheated apparatus.

2. The resulting flame travels with great rapidity, heating and expanding the air with explosive violence. This is called a primary explosion.

3. The primary explosion dislodges dust that has accumulated on parts of the structure and equipment, and forms a new dust-cloud.

4. This dust cloud usually is more dense than the previous one and explodes with greater violence. This is called a secondary explosion.

In Class III and IV locations, where there are linters and other combustible materials in storage, similar precautions are also necessary. Dust tight equipment is required to prevent the possibility of dust being fired by a spark.

It remains but for those who design or install wiring in hazardous locations, to consult the rules under Article 32. If there is doubt about the meaning of these rules, electrical inspectors and hazardous location equipment specialists are always ready to lend their experienced aid to eliminate hazards.

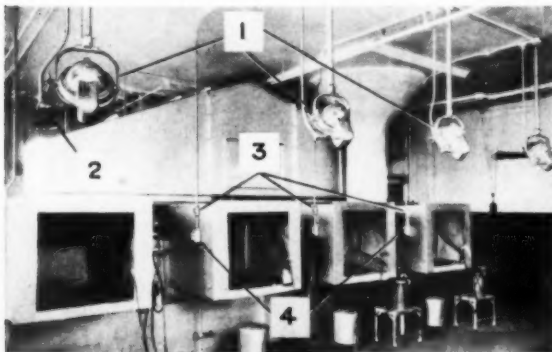
Hazardous Locations Classified

INDUSTRIAL research has been going on in the United States intensively for twenty years. During this time the whole surface of modern industry has changed. As old products have been discarded, new ones involving processing hazards have been presented. Outstanding illustrations are the spray painting, dry cleaning, compounding, oil and distilling industries.

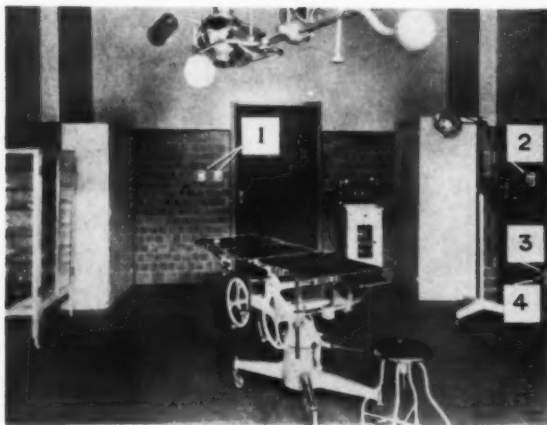
Today, there are approximately 130 different types of industrials, that have hazardous conditions, in one department or another. But this simplified list will serve as a general guide. Some industries or processes are shown as hazardous, under several classifications. Other plants may have only one operation, which falls in Class I. or II., while the major areas are standard, or perhaps only Class III. or Class IV. hazards.

It should be borne in mind, however,

that hazardous processes are found in the most unexpected places. They may have just been adopted within that factory and the risks involved may not yet be recognized. No electrical equipment should be installed, therefore, in any building where chemicals or dusts of any kind are present, without careful investigation. Check each new condition with these tables. In case of doubts, consult an authority on explosion hazards.



EXPLOSIVE FUMES from this battery of spray room booths necessitated equipping the whole room with explosion-proof devices.



HOSPITALS can have explosions during operations. Here switches and plugs are all safeguarded with approved fittings.

SOME HAZARDOUS INDUSTRIES

And the Types of Hazard They Present

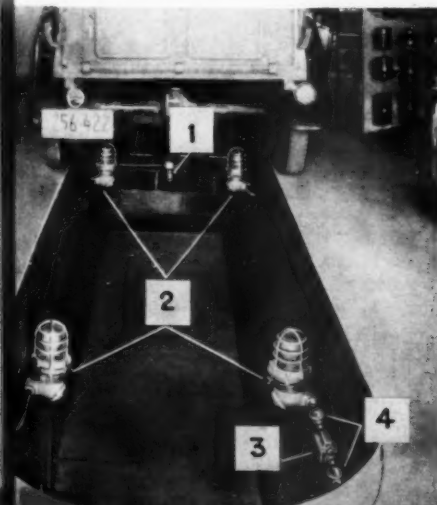
	Class of Hazard			
	I	II	III	IV
Automobile Mfg.	X		X	X
Breweries	X	X		
Bulk Stations (Oil)	X			
Candle Making	X			
Chemical Plants	X	X		
Coal Mining	X	X		
Coke Plants	X	X		
Cold Storage	X			
Cordage, Rope & Twine			X	X
Cotton Compresses, Gins & Mills			X	X
Cotton Nitrating Plants	X		X	X
Department Stores	X		X	X
Disinfectant Works	X			
Distilleries	X	X		
Dry Cleaning and Oil Separation	X		X	X
Dye Works	X		X	X
Ether Plants	X			
Feed Mills		X	X	X
Fertilizer Plants	X	X		
Filling Stations	X			
Flavoring Extract Plants		X	X	X
Flour and Cereal Mills		X	X	X
Food Processing	X	X	X	X
Furniture Plants	X		X	X
Garages	X			
Garments — Boots, Shoes, Hats, Clothes	X	X	X	X
Gasoline Stations	X			
Gas Plants	X	X		
Grain Elevators		X	X	X
Hangars — Aeroplane	X			
Hospitals	X			
Ice Plants	X			
Ink Factories	X	X		
Insulated Wire Plants	X			
Jewelry Mfgs.	X			
Lacquer Mfgs.	X			
Leather Mfgs.	X	X	X	X
Liquor Distilleries	X	X		
Machine Shops	X	X		
Marine Oil Terminals & Bulk Stations	X			
Mattress Factories		X	X	X
Milling		X	X	X
Oil Cloth — incl. Linoleum, etc.	X	X	X	X
Oiled Clothing Mfgs.	X	X	X	X
Oil Refining — Animal, Veg. and Mineral	X			
Oil Separation Plants	X			
Paint Shops	X	X		
Paper Mfg.	X		X	
Perfumery Laboratories	X			
Photogravure Shops	X			
Power Plants		X		
Printing Plants	X	X		
Pyroxilin Plastic (Celluloid) Plants	X	X	X	X
Rayon Plants	X	X	X	X
Rubber Goods	X	X		
Sewage Disposal	X			
Soap Plants	X			
Storage Battery Factories	X			
Tanneries (Leather)		X	X	
Textile Industry		X	X	X
Tunnels, Automobile Highway	X	X		
Upholstering			X	X
Varnish Plants	X	X		
Warehouses, Grain and Other Combustibles	X	X	X	X
Wax Solvent Plants	X			
Wood Distillation Plants	X			
Woodworking Plants		X		
Wood Flour Plants		X		

SOME HAZARDOUS PROCESSES Encountered in a Variety of Industries

CLASS OF HAZARD

	I	II	III	IV
Boiler and Fuel Handling Rooms	X	X		
Cleaning and Wash Racks	X			
Coal and Coal Tar Distillation	X	X		
Coating (Cloth and Paper)	X			
Crushing		X		
Cutting, Punching, Stamping		X	X	
Dipping Tanks and Vats	X			
Distillation	X			
Dusty Processes:				
Cereals		X		
Cocoa		X		
Feed		X		
Fertilizers		X		
Flour		X		
Grain		X		
Starch		X		
Sugar		X		
Sulphur Dust		X		
Carbon Black		X		
Coal Dust		X		
Coke Dust		X		
Lamp Black		X		
Aluminum		X		
Bronzing Powder		X		
Magnesium		X		
Fermentation Products (Alcohols)	X			
Grain Cleaning, Conditioning and Handling	X	X	X	X
Grinding, Planing, Polishing, Sawing		X	X	
Handling, Loading and Transferring		X	X	X
Lacquer Plasticizers and Softeners	X	X		
Lacquer Solvents	X			
Metal Cleaning and Finishing		X		
Molding and Pressing	X	X	X	
Pulverizing		X		
Refrigeration	X			
Rolls and Finishing Processes		X	X	
Spray Booths	X			
Stocking and Storing	X	X	X	X
Tank and Bin Emptying	X	X	X	
Vaporizing	X			

GREASE PITS can be protected against explosive vapors with approved lights, plugs and controls.



Explosive Chemicals and Dusts

A FULL list of the hazardous chemicals and dusts, encountered in industry today, would be far too long for presentation here. It would provide a complicated array of chemical terms of no practical value to the contractor.

The precise characteristics of these different substances vary widely and are only understood by the chemist. But the following table gives the explosive limits of a few of them—

	Explosive Limits Ignition		Temperature	Vapor Density
	% in Air		Deg. F.	
	Lower	Upper		
Gasoline	1.4	6	527	3-4
Acetone	2	13		
Benzol	1.4	8		
Ethyl Ether	1.9	22	356	256
Ethyl Alcohol	3.5	19		
Naphtha V. M. & P.	1.2	6	500	.55
Methane (Gas)	5.6	13.5		
Illuminating Gas	5	31		

It will be seen from this table, that a vapor-air mixture in which the gasoline vapor is so low as 1.4 per cent presents an explosive combination. Therefore, if the pump room in a bulk oil plant, where gasoline is being pumped, has 98.6 per cent by volume of good air, and 1 1/4 per cent gasoline vapor content, such an area has a 1.4 per cent rich mixture and will explode if ignited.

The list of explosive dusts provided for under Class II hazards is shorter, but its life and property losses are very large. Dust-clouds, thrown off in handling and processing many organic substances, explode with great violence when ignited. This hazard is too often not recognized, but explosions from these sources are exceedingly destructive and usually result in disastrous fires. Some of the more common combustible dusts are:

Food Industry Dusts

Grain	Rice	Dried Milk
Flour	Starch	Cocoa
Sugar	Dextrin	Spice

Miscellaneous Industrial Dusts

Coal	Hard Rubber
Carbon Black	Soap
Wood	Aluminum
Cork	Bronze
Sulphur	Magnesium

Other Metals

These materials when finely divided into dust particles expose an enormous surface to the air. If the temperature is raised to the ignition point, a particle, due to its small mass, burns almost instantly, and ignites neighboring particles. The rapidity with which the flame travels and the great heat that is liberated produces an explosion.

It is possible, however, to indicate the more common chemicals, encountered in hazardous locations in industry today. And it is well to have in mind that Class I and Class II devices and fittings must be used in electrical systems, installed where the following materials are present—

Acetone	Ethylene
Amyl Acetate	Ethyl Ether
Benzine	Formaldehyde
Benzol	Gasoline
Butone	Hexone
Butyl Acetate	Hydrogen Sulphide
Butyl Alcohol	Illuminating Gas
Camphor	Kerosene
Carbon Disulphide	Methane
Carbon Monoxide	Methyl Acetate
Cleaning Solvents of the kerosene class	Methyl Alcohol
Naphtha	Naphtha
Stoddard Solvent	Naphtha V M & P
Varnolene	Naphtha (Solvent)
Varsol	Natural Gas
Coal Gas	Pentone
Denatured Alcohol	Petroleum Ether
Ethane	Propylene
Ethyl Acetate	Pyroxyline Solution
Ethyl Alcohol	Toluol
Ethyl Chloride	Xylene

This short list of 38 chemicals is a selection from a long one having 328 names, all of which are hazardous in one way or another. However, many chemicals commonly used in industry today are combinations of chemicals that in turn produce a new name and hazard. A complete list can be secured from the National Fire Prevention Association, Boston, Mass. or from the prominent manufacturers of conduit fittings for hazardous locations. These lists were prepared from tests made by chemical and explosion experts.

What Makes It Explosion Proof

THE fundamental requirement for electrical equipment, of the explosion-proof type, is to prevent the flames of ignited gases or vapors from passing out of equipment enclosures to the surrounding atmosphere. This forms the basis for the construction and design of motors, control apparatus, distribution and protective equipment, fittings, and various other parts of the electrical system, that are to be operated in explosion-hazard areas.

It is further recognized that sparks and gases at high temperatures are also capable of causing ignition. The openings in an electrical system enclosure, therefore, must be of a design and dimension that will prevent ignition by escaping flame, sparks, or hot gases.

As a result of actual explosion tests, over a long period, under average conditions, this high degree of protection has been achieved. Explosion proof equipment is now available that will completely enclose motors, circuit breakers, controllers, switches, panels and lamps, and provide other fittings, necessary to completely safeguard a metal

system. This equipment has been developed by the manufacturers, since Article 32 was written into the code, and is still in process of expansion. It will undoubtedly be further extended to signal and communication devices, with sparking contacts. Explosion proof type push buttons and bells and telephone enclosures are already on the market, but not as approved devices. To illustrate the measures which must be taken to safeguard a piece of apparatus against explosion hazards, the motor offers an excellent example.

The ordinary type of electrical motor permits the surrounding air to pass into

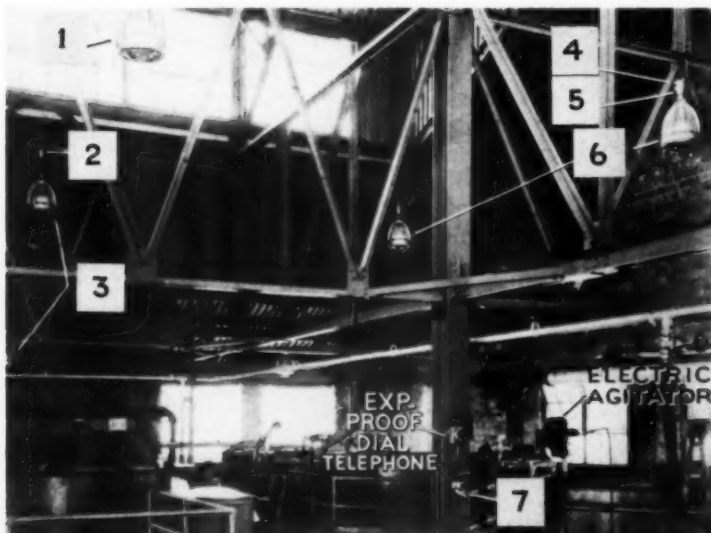
its interior. If a flammable vapor or gas is present, it may be ignited by a spark, from the brushes or slip rings or from a short circuit, caused by injured or defective insulation. High temperatures, from overload or burnout in an ordinary motor, may also ignite such vapor or gas.

It is impractical to employ a gas-tight enclosure, excluding all vapor from arcing or sparking parts, in the interior of motors or other electrical apparatus. Even hermetically sealed enclosures would not remain gas-tight very long, under service conditions. This is particularly true, where moving parts pass through the enclosure, as at the shafts of motors or shafts for operating switches, and for control apparatus. Attempts to make enclosures for motors or other electrical equipment gas or vapor-tight, by the use of gasket materials such as rubber, have not been successful. So effort has been directed to the design of the openings in explosion-proof enclosures at joints and shaft entrances.

The openings in a modern type of fan-cooled explosion-proof motor are detailed in the accompanying drawing. The shaft opening is shown at C-D, and the end shield joint at A-B. The distance A-B is termed the "length of flame path," and the unoccupied space in the enclosure is known as the "free volume." On a motor of this type, the vapor or gas diffuses through the openings or clearances, filling the free space inside of the enclosure. If ignition occurs, the flame spreads and pressure is produced by the expansion of gaseous products of combustion. If the length of path at the joints is long enough, and the clearance is small enough, the flame will be arrested between A and B, and C and D, thus preventing igni-

By A. H. Nuckolls

*Chemical Engineer,
Underwriters' Laboratories, Inc.,
Chicago, Ill.*



DISTILLERY ROOMS like this cistern area (Class I) contain numerous devices that must operate safely in fume-laden atmosphere.

tion of the surrounding gases or vapors.

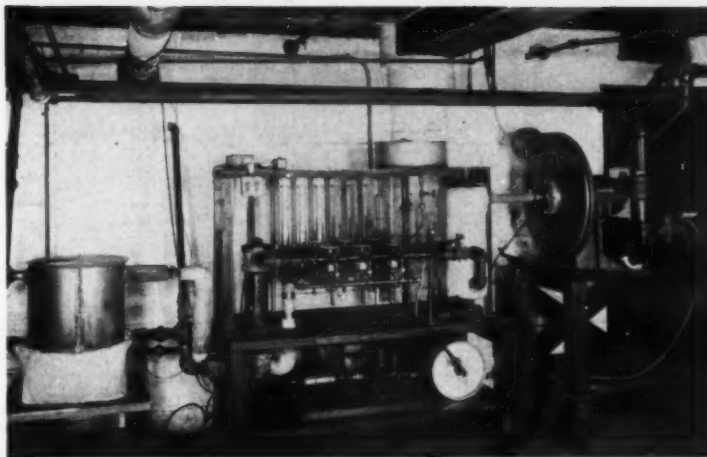
The other drawing gives some details of commonly used explosion proof openings or joints. A threaded joint of five full threads, is an excellent flame arrester. It will be noted that the openings at point "O" are increased more or less, during the explosion, by the pressure effect. The enclosure must therefore be constructed not only to meet service requirements, but also to withstand the maximum internal explosion pressures that may be developed, without rupture or appreciable distortion. It is equally important that bolts be of adequate strength.

The unoccupied space of the enclosure must be small enough to avoid the danger of detonations. It is also important to avoid forms of enclosure that divide the free volume into communicating compartments, which may cause abnormally high pressure effects known as "pressure piling." This effect comes when an explosion, beginning in one compartment of the enclosure, causes compression and turbulence of the gaseous mixture in another compartment, in advance of the flame front. Motors are subject also to burn-out, and it is required, therefore, that if a burn-out occurs, the enclosure does not reach a dangerous temperature.

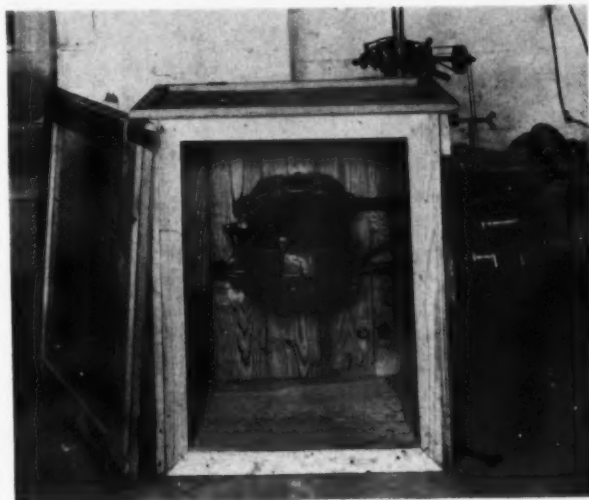
No Weak Spot

It is clear too that the leads or conductors must be tightly fitted or sealed, and securely held in place, where they pass into the explosion-proof enclosure. The code requires that rigid conduit, with explosion-proof joints and fittings, shall be employed. But when rigid connection is impractical, as in installations where it is necessary to shift the motor on its base, an explosion-proof flexible fitting is permitted. It is important that all fittings, including outlet boxes, be of the explosion-proof type. There is also a provision for sealing off conduit runs at terminal boxes, switch boxes, and similar places. The sealing compound must have a high softening point (200 deg. F.) and not be affected by the atmosphere, in which it is designed for use, and other substances it may contact.

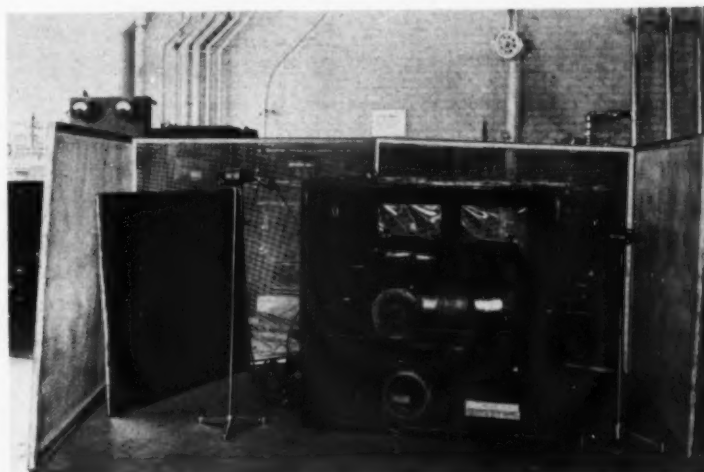
There is a wide difference in the explosive properties of many gases and vapors. The chart shows the explosion pressure curves for mixtures of air with acetylene, propane, and ammonia. The maximum explosion pressure of acetylene is much higher than that of ammonia or propane. It will be clear, therefore, that an enclosure of sufficient strength for propane will not be safe for use with acetylene. So flammable



TESTING FOR SAFETY—This "carburetor" apparatus in the laboratory, provides exact gas-air mixtures in large volume.



TO WATCH IT BLOW—Equipment is tested in plain sight under conditions that simulate actual service.



A BIG ONE—Test installation at the laboratory for a 100-hp. motor designed for a Class I, Group D location.

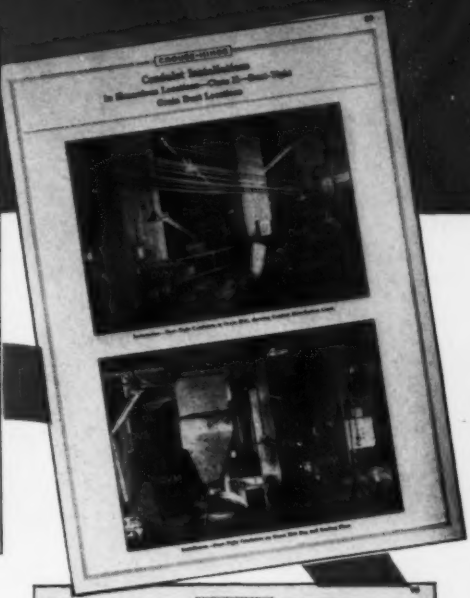
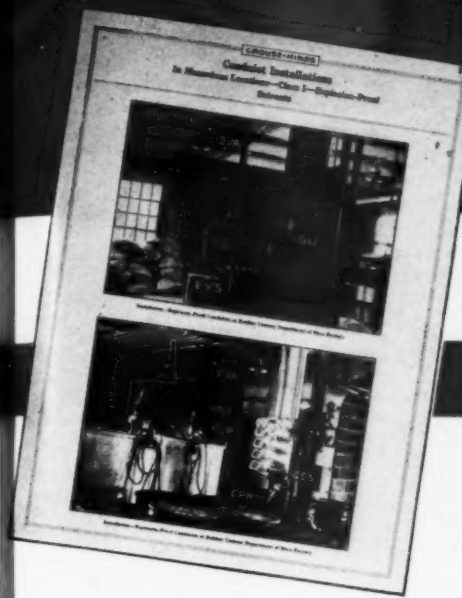
CONDULET INSTALLATIONS

IN HAZARDOUS LOCATIONS



CROUSE-HINDS

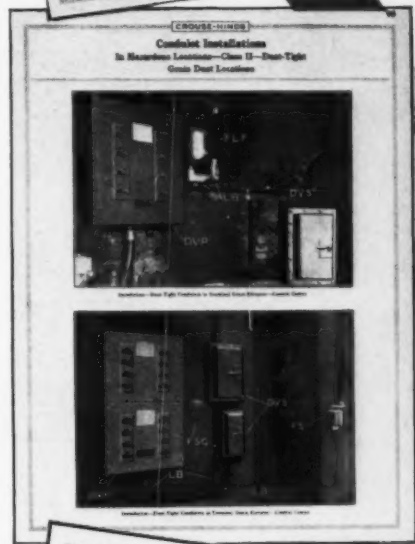
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Due to the great number of requests for suggestions as to how best to meet electrical installation problems in hazardous locations, this Bulletin has been published.

This Bulletin is not offered as a treatise on electrical installations in hazardous locations, nor is it an explanation or an interpretation of the requirements of the National Electrical Code; but rather it is a pictorial presentation of how requirements have been met under a large variety of conditions.

In addition to 131 actual installation photographs, there are 32 pages of tables of Flammable Liquids and Gases: Hazardous Properties; and Classifications, According to Chemical Characteristics, Sources, and Uses in Industries and Products. These tables will be found helpful in determining the degree of hazard brought about by the handling and use of such liquids and gases.



CROUSE-HINDS

Flammable Liquids and Gases
For Class I Hazardous Locations
Table II—Classification, According to Chemical Characteristics, Sources, and Uses in Industries and Products

One-Bottomed with Table I—Hazardous Properties

In Table II, "Characteristics," refers to the flammable and explosive limits of the vapors of the liquid or gas, as determined by the National Fire Protection Association (NFPA) in its "Flammable and Explosive Limits" series of publications. These limits are determined by the NFPA and are not to be confused with the limits of the National Electrical Code. These limits are determined by the NFPA and are not to be confused with the limits of the National Electrical Code.

No.	Classification	Chemical Characteristics	Source	Uses in Industries and Products
1	Acetylene	Acetylene	Acetylene	Acetylene
2	Acetylene	Acetylene	Acetylene	Acetylene
3	Acetylene	Acetylene	Acetylene	Acetylene
4	Acetylene	Acetylene	Acetylene	Acetylene
5	Acetylene	Acetylene	Acetylene	Acetylene
6	Acetylene	Acetylene	Acetylene	Acetylene
7	Acetylene	Acetylene	Acetylene	Acetylene
8	Acetylene	Acetylene	Acetylene	Acetylene
9	Acetylene	Acetylene	Acetylene	Acetylene
10	Acetylene	Acetylene	Acetylene	Acetylene
11	Acetylene	Acetylene	Acetylene	Acetylene
12	Acetylene	Acetylene	Acetylene	Acetylene
13	Acetylene	Acetylene	Acetylene	Acetylene
14	Acetylene	Acetylene	Acetylene	Acetylene
15	Acetylene	Acetylene	Acetylene	Acetylene
16	Acetylene	Acetylene	Acetylene	Acetylene
17	Acetylene	Acetylene	Acetylene	Acetylene
18	Acetylene	Acetylene	Acetylene	Acetylene
19	Acetylene	Acetylene	Acetylene	Acetylene
20	Acetylene	Acetylene	Acetylene	Acetylene
21	Acetylene	Acetylene	Acetylene	Acetylene
22	Acetylene	Acetylene	Acetylene	Acetylene
23	Acetylene	Acetylene	Acetylene	Acetylene
24	Acetylene	Acetylene	Acetylene	Acetylene
25	Acetylene	Acetylene	Acetylene	Acetylene
26	Acetylene	Acetylene	Acetylene	Acetylene
27	Acetylene	Acetylene	Acetylene	Acetylene
28	Acetylene	Acetylene	Acetylene	Acetylene
29	Acetylene	Acetylene	Acetylene	Acetylene
30	Acetylene	Acetylene	Acetylene	Acetylene
31	Acetylene	Acetylene	Acetylene	Acetylene
32	Acetylene	Acetylene	Acetylene	Acetylene

CROUSE-HINDS

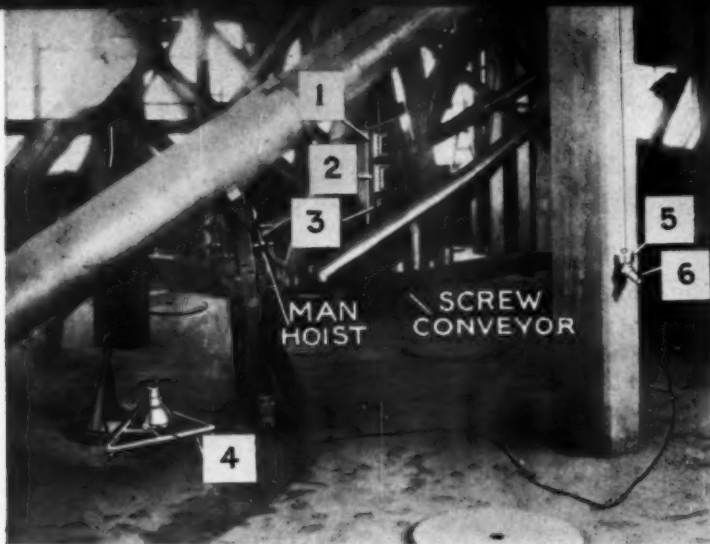
Flammable Liquids and Gases
For Class I Hazardous Locations
Table I—Hazardous Properties

No.	Substance	Flash Point	Boiling Point	Specific Gravity	Explosive Limits	Class	Group
1	Acetylene	-81	-84	1.1	2.5-100	I	A
2	Acetylene	-81	-84	1.1	2.5-100	I	A
3	Acetylene	-81	-84	1.1	2.5-100	I	A
4	Acetylene	-81	-84	1.1	2.5-100	I	A
5	Acetylene	-81	-84	1.1	2.5-100	I	A
6	Acetylene	-81	-84	1.1	2.5-100	I	A
7	Acetylene	-81	-84	1.1	2.5-100	I	A
8	Acetylene	-81	-84	1.1	2.5-100	I	A
9	Acetylene	-81	-84	1.1	2.5-100	I	A
10	Acetylene	-81	-84	1.1	2.5-100	I	A
11	Acetylene	-81	-84	1.1	2.5-100	I	A
12	Acetylene	-81	-84	1.1	2.5-100	I	A
13	Acetylene	-81	-84	1.1	2.5-100	I	A
14	Acetylene	-81	-84	1.1	2.5-100	I	A
15	Acetylene	-81	-84	1.1	2.5-100	I	A
16	Acetylene	-81	-84	1.1	2.5-100	I	A
17	Acetylene	-81	-84	1.1	2.5-100	I	A
18	Acetylene	-81	-84	1.1	2.5-100	I	A
19	Acetylene	-81	-84	1.1	2.5-100	I	A
20	Acetylene	-81	-84	1.1	2.5-100	I	A
21	Acetylene	-81	-84	1.1	2.5-100	I	A
22	Acetylene	-81	-84	1.1	2.5-100	I	A
23	Acetylene	-81	-84	1.1	2.5-100	I	A
24	Acetylene	-81	-84	1.1	2.5-100	I	A
25	Acetylene	-81	-84	1.1	2.5-100	I	A
26	Acetylene	-81	-84	1.1	2.5-100	I	A
27	Acetylene	-81	-84	1.1	2.5-100	I	A
28	Acetylene	-81	-84	1.1	2.5-100	I	A
29	Acetylene	-81	-84	1.1	2.5-100	I	A
30	Acetylene	-81	-84	1.1	2.5-100	I	A
31	Acetylene	-81	-84	1.1	2.5-100	I	A
32	Acetylene	-81	-84	1.1	2.5-100	I	A

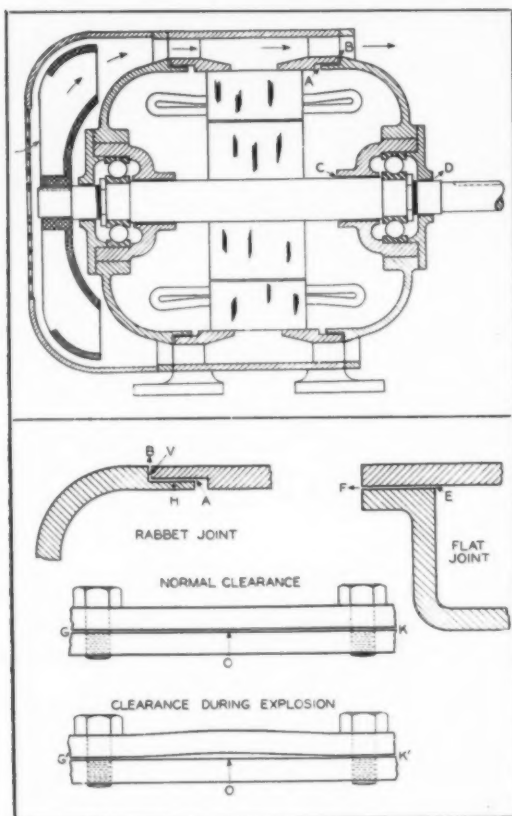


CROUSE-HINDS COMPANY
SYRACUSE, N. Y., U. S. A.

Sales Offices: Atlanta — Boston — Chicago — Cincinnati — Cleveland — Dallas — Detroit — Kansas City — Los Angeles — Milwaukee — Minneapolis — New York — Philadelphia — Pittsburgh — San Francisco — Seattle — St. Louis — Washington

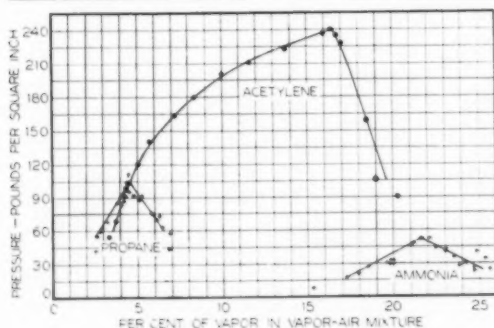


GRAIN HANDLING produces clouds of explosive dust for which lights, controls and all other outlets must be Class II equipped.



AN EXPLOSION PROOF MOTOR — Enclosures must have sturdy frames with openings for arresting internal explosions.

EXPLOSION PROOF JOINTS — Joints in enclosures are held to extremely accurate clearances.



EXPLOSIONS DIFFER — Variation in pressure and richness of mixture complicate the ignition problems of explosion protection.

gases or vapors have been subdivided into groups, designated "A", "B", "C", and "D", and the test requirements, based on the hazard-group for which the equipment is intended to be used, is indicated on the nameplate and in our lists.

Group "A," most hazardous of the groups, is represented by acetylene.

"B" refers to atmospheres containing hydrogen, or gases or vapors of similar hazard, such as manufactured gas (illuminating gas).

"C" refers to atmospheres containing ethyl ether vapor, or gases or vapors of equivalent hazard.

"D", which is the most common group, refers to atmospheres containing vapors of gasoline, or vapors or gases of equivalent hazard, such as petroleum, naphtha, lacquer solvents, natural gas.

It may be asked, "Why not design a motor or other electrical equipment for use with the most explosive gas met with in practice?" Like many theories, this one cannot be satisfactorily applied in practice. For example, a motor constructed for safe use in acetylene gas would be far more expensive and massive in construction than a motor for use in gasoline vapor.

Tests Prove Safety

So, through an elaborate system of tests, specifications have been developed, that provide an adequate protection from the different classes of hazards, for which the equipment is designed. In order to obtain the necessary control of the concentrations of vapor and air for these explosion tests, without undue expenditure of time and work, it is necessary to employ special equipment. An apparatus called "the carburetor" is shown. It is capable of giving a constant mixture of vapor and air, in large volume, in predetermined proportions. With this apparatus and accumulated data, it is possible to determine by tests, whether electrical apparatus is so designed and constructed as to function safely in explosive atmospheres.

An actual test installation also, is shown, connected to the power line. The front of the explosion chamber, which contains the explosive mixture surrounding the electrical equipment under examination, is made of readily replaceable transparent material. This enables an observer, protected by barricades, to note whether an explosion, in the electrical enclosure, causes ignition of the surrounding explosive mixture in the box. In case ignition of the surrounding mixture does not occur, he sees whether dangerous sparks or flame are discharged from any of the openings of the electrical enclosure.

Electrical Contracting, July 1937



Three 100-kva G-E Pyranol transformers installed at the plant of the Eli Lilly Co., Indianapolis, Ind.

PYRANOL TRANSFORMERS SHOW SUBSTANTIAL SAVINGS IN INDOOR INSTALLATION

THE Eli Lilly Company of Indianapolis, manufacturing chemists, made a substantial saving in total installed transformer cost when it ordered G-E Pyranol transformers for this new installation. Short runs of secondary cable were desired, and Pyranol transformers could be installed at the load center without the expense of heavy vault construction. Installation of oil-filled transformers outdoors to save vault-construction expense would have entailed long secondary cable runs and would have marred the attractive appearance of the plant. This installation was made in the basement—the nonflammable, nonexplosive Pyranol

transformers affording a high degree of safety.

• It will pay you to use Pyranol transformers for your plant—particularly if you are considering a new indoor installation. Recognition of Pyranol by the National Electrical Code permits their installation indoors with many of the restrictions applying to oil-filled transformers removed.

More than 300,000 kva of these transformers are installed—many having been operating more than five years—all giving excellent service. For complete information write the nearest G-E sales office, or General Electric Company, Dept. 6J-201, Schenectady, N. Y. Ask for Bulletin GEA-2048.

YOU CAN'T BURN



PYRANOL

300-51

GENERAL  **ELECTRIC**

Estimating Explosion-Proof Wiring

MANY industrial contractors have complained about the ridiculously low bids that are often made for installing wiring in hazardous locations. The reason is that no labor units were heretofore made public on explosion proof wiring and too much was left to guesswork. The accompanying tables present a guide to estimating this type of construction, based on the experience of a number of contractors skilled in this work.

By F. J. Seiler

*Associate Editor,
Electrical Contracting*

While these units are not expected to cover many unusual variables that may be encountered, estimators from various localities have recorded their own production experience on large and small explosion-proof installations. Particular credit is due: Crescent Electric Co., Kansas City; McCarthy Bros. & Ford, Buffalo, E. J. White Co., Newark, and Sweningson Electric Co., Chicago. This first set of tables will be followed by additional data in future issues.

On first thought, many estimators consider wiring in hazardous locations as differing only slightly in cost from standard work. The extent that fittings are larger or clumsier to install is but one factor. Upon taking a close account of explosion-proof wiring in its other phases, however, several logical and necessary adjustments must be made to cover the additional labor costs that occur. In general, higher costs arise when installing conduit, outlet fittings, fastenings, wire, devices, controllers, panels, lighting equipment, and also in making final connections. Fur-

thermore, varying quantities of sealing fittings must be installed and filled with compound. These fittings are not encountered when doing standard work in non-hazardous areas.

All work done in hazardous locations is usually subjected to very rigid inspection by safety-minded executives and outside engineers. Therefore, the natural tendency for wiring crews is to take greater care with every operation. If additional work must be done in existing plants, such as chemical works, there is considerable time lost for rest periods. Gaseous or dusty atmospheres are often so harmful to workmen that gas masks must be worn, and work frequently limited in such areas to two-hour periods.

New installations, whether they consist of partially concealed or surface wiring, involve several definitely approachable cost factors. These tables give separate consideration to the progressive operations that go to make up the completed job.

To cover the subject as completely as possible, estimating tables have been

prepared covering: conduit, elbows, terminals and unions, fastenings and drillings, wire and cable, fittings and sealing, devices and fixtures, connections and terminals, handling and mounting equipment, motor setting, miscellaneous weight, and supervision and handling.

Each of these tables represents a departure from the standard cost units for doing work in non-hazardous areas. Explanation is made in the subsequent paragraphs accompanying each of these tables, to make clear to the estimator why higher values have been assigned for hazardous-location wiring.

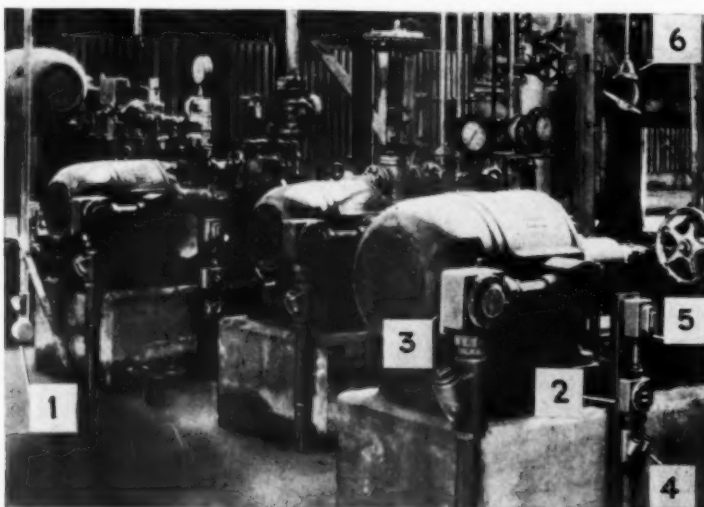
TABLE 1. General cost factors involved, for which additional allowances should be made

	Size of Job		
	2/5 Men	6/20 Men	21 or More
A. Job Layout—Add to total cost...	5%	4%	3%
B. Job Supervision—Add to total labor cost.....	15%	10%	7½%
C. Extra office detail and expense—Add to total material cost...	3%	3%	2%
D. Lost Time & Rest	See Special Notes		

Table 1—General Costs. Several inescapable elements of cost are encountered in doing work in hazardous locations, for which proper allowances must be made. These allowances add to the estimated labor, or to the total cost of the estimate, according to the approximate percentages given.

Item 1-A, *Job Layout* is charged to the total cost, because some jobs of low labor content may involve considerable expense for developing a detailed layout. An equitable allowance is therefore made when total cost is used.

Item 1-B, *Job Supervision*, may vary with the nature of each job. However, close supervision of explosion proof jobs is necessary to avoid costly changes. If workmen should install their work incorrectly, it is not readily rearranged.



CAREFUL ESTIMATING is essential in hazardous areas cluttered with many odd-shaped fittings and conduit connections.

The RALCO Line

EXPLOSION PROOF GASOLINE PUMP JUNCTION BOXES AND UNIONS

In order to meet the revised requirements of the Underwriters' Laboratories, relative to increasing the width of the metal to metal seat on conduit unions, we show our method of so doing by the illustration at left.

By the use of concentric "V" grooves and ridges in both members of the union, these new requirements have been met and at the same time keeping the overall dimensions the same as they were on former unions made by us.



Illustrating
"V"
Grooves



UM



U



UL

JUNCTION BOXES

The Junction Boxes and Unions illustrated are designed in accordance with the Underwriters' Laboratories requirements for Class I, Group D, locations.

The combination of these Junction Boxes and Unions will meet the various wiring conditions encountered when wiring new gasoline dispensing pump installations, or when rewiring old installations to comply with Code requirements.

XPH series Junction Boxes are made with integral union hubs.



XPH-3



XPH-4



XPH-5

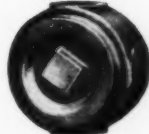
These boxes when used in combination with the unions, union elbows and plugs to close unused openings, make many wiring combinations possible and which can be readily appreciated when the wiring conditions are not known in advance.



XP-3C



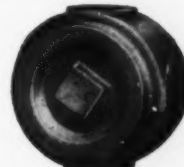
XP-3X



XP-3



XP-4X



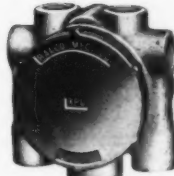
XP-4



XPG



XPU-7



XPU-8



XPU

For Full Information on Explosion Proof Junction Boxes and Unions—Send for Bulletin No. 120-D.

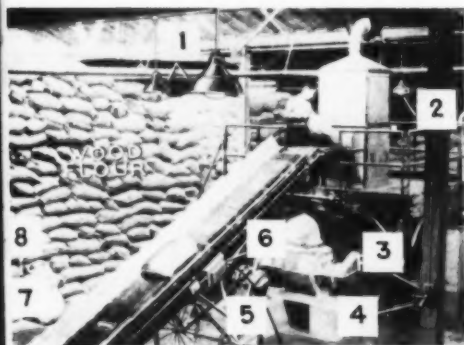
RALCO MANUFACTURING CO.

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CHICAGO, ILLINOIS

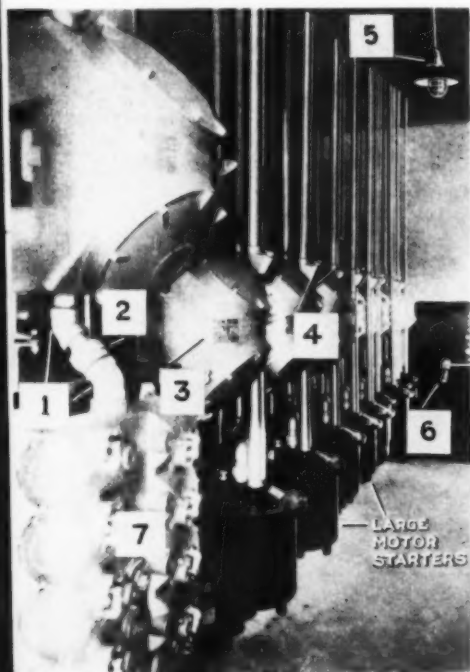
Item 1-C, *Extra Office Expense* is usually incurred because special orders must be placed to supply the needs for an explosion-proof job. Since various equipment and fittings are not regularly carried by wholesalers, unforeseen parcel post and express charges must be paid, also telegram charges. When a job is completed, the left-over items must be returned for credit or placed in stock. Slow turn-over on unused special fittings builds up carrying charges in the office. Finally, any job that employs a large amount of specially-ordered materials takes considerable attention in the office from regular routine matters.

Item 1-D, *Lost Time and Rest* can only be estimated fairly by making a careful study of the working conditions to be met. If work must be installed in a plant that is operating, the presence of toxic fumes, objectionable dusts, excessive temperatures, or extremely dangerous explosive vapors will cause wide variation in the work performed.



SCATTERED OUTLETS (Above) require exacting bends and many drilled fastenings at machinery and structural steel.

HEAVY ENCLOSURES (Below) for explosion-proof control and distribution groups require exacting assembly, pipe connections and sealings.



It is therefore impractical to assign a given percentage value for marking up the total labor to take care of unfavorable working conditions in a portion of the job. For instance, a job may be estimated to require 2,000 manhours at normal production, in which one objectionable working area will require a 300% markup. But the normal time in that portion may amount to only 50 manhours. On the other hand, a 1,000-manhour job may have one-half the work, requiring 500 manhours, so located that the estimated labor for that portion should be doubled or trebled.

Estimates made for installing work in new buildings generally are not affected unfavorably, except when certain departments of the new plant are in service, and thus become hazardous areas before all electrical work is completed.

Conduit Units

Conduit units, as presented in Table 2, cover the four common installation conditions. It must be noted that several differences in cost are incurred, depending upon whether work is exposed or concealed. In exposed work,

TABLE 2. Explosion-Proof Conduit Installation

Man-hours per 100 feet	Class of Work			
	A	B	C	D
1/2-in.	2.5	2.3	2.2	3.9
3/4-in.	3.3	3.0	2.7	5.1
1-in.	4.1	3.9	4.0	7.6
1 1/4-in.	5.0	5.0	5.0	10.0
1 1/2-in.	6.1	5.6	5.4	11.0
2-in.	8.0	7.0	6.9	14.0
2 1/2-in.	10.0	9.0	8.9	...
3-in.	13.6	12.0	12.0	...
3 1/2-in.	15.2	13.3	...	...
4-in.	16.0	14.9	...	...

Class A: Exposed work run on walls and ceilings, not over 10 ft. above the floor.

Class B: Exposed work run on racks, comprising groups of three or more conduits, and not over 10 ft. above the floor.

Class C: Conduits installed on concrete forms, or concealed in masonry walls.

Class D: Conduit fitted to machinery.

Add for high ceilings:

For 11 to 15-ft. ceiling runs add—5%

For 16 to 20-ft. ceiling runs add—20%

Above 20-ft. ceiling runs—Special consideration must be given. Allow at least 2% additional for each foot above 20 feet. Sometimes such work requires special scaffolding. Extension ladder work may require units being doubled.

NOTE: The above units do not include labor for terminals at fittings, panels, junction boxes, etc. Drillings, racks, and other supporting operations not included.

their labor costs gradually increase as the ceiling heights increase. Also, exposed conduit must often be fitted in an exacting manner to the frames of mixers, cookers, and other processing equipment, so higher units have been assigned for the estimator who desires to segregate the take off of the quantities of such conduit runs.

Although separate labor units appear elsewhere covering the cost of installing elbows, connecting terminals and unions, and fastening or supporting the runs of conduit, several items of extra cost are directly involved when conduit is installed.

Why Costs Are Higher

First, runs must be carefully aligned, if they are to fit squarely and make a tight joint. All bends and offsets are, therefore, made with greater accuracy and care. Since fittings used at various outlets are of varying sizes and shapes, mechanics will be less familiar with taking quick measurements for cutting, threading and assembling lengths of conduit. Often a dense layout of fittings involves difficult bends, and they must be laid out on the floor for makeup before being erected.

Labor units for elbows and terminals in Table 3 are adversely affected by the same factors discussed in Table 2 for conduit. Estimators have several methods for including the cost for elbows and terminals. In these tables, the terminal labor is used only for runs connected to panels, junction boxes, switches, or places other than regular outlet or sealing devices. The latter connections are covered in tables that cover the installation of fittings on the per-hub basis.

TABLE 3. Explosion-Proof Wiring, Conduit Elbows, Terminals and Unions

Man-hours each	Elbows	Terminals	Unions
1/2-in. ....	.....	.28	.10
3/4-in. ....	.....	.30	.12
1-in. ....	.9	.38	.14
1 1/4-in.	1.5	.52	.20
1 1/2-in.	1.8	.68	...
2-in.	2.1	.80	...
2 1/2-in.	3.8	1.3	...
3-in.	4.5	1.65	...
3 1/2-in.	5.2	2.0	...
4-in.	6.2	2.3	...

NOTE: Labor units for terminals apply where conduit is run into panels, junction boxes, motor switches and controllers, etc. Conduit connections at outlets such as fixtures, devices and sealing fittings are to be estimated from labor units for installing hub fittings as covered elsewhere in this series of tables.

What to Buy and Who Makes It

Auxiliary Control Devices

Allen-Bradley Co.—Class I and II
Milwaukee, Wis.
Appleton Electric Co.—Class I and II
Chicago, Ill.
Arrow-Hart & Hegeman Electric Co.—Class I and II
Hartford, Conn.
Automatic Switch Co.—Class I
New York, N. Y.
Crouse-Hinds Co.—Class I and II
Syracuse, N. Y.
Cutler-Hammer, Inc.—Class I
Milwaukee, Wis.
Electric Controller & Mfg. Co.—Class I
Cleveland, Ohio
General Electric Co.—Class I and II
Schenectady, N. Y.
Killark Electric Mfg. Co.—Class I
St. Louis, Mo.
Rowan Controller Co.—Class I
Baltimore, Md.
Russell & Stoll Co., Inc.—Class I
New York, N. Y.
Square D Company—Class I and II
Detroit, Mich.
Westinghouse Electric & Mfg. Co.—Class I
East Pittsburgh, Pa.

Circuit Breakers

Appleton Electric Co.—Class I and II
Chicago, Ill.
Crouse-Hinds Co.—Class I and II
Syracuse, N. Y.
Pyle-National Co.—Class I
Chicago, Ill.
Russell & Stoll Co., Inc.—Class I
New York, N. Y.
Square D Company—Class I and II
Detroit, Mich.

Conduit Fittings

Adalet Mfg. Co.—Class I
Cleveland, Ohio
Adapti Co.—Class I
Cleveland, Ohio
Appleton Electric Co.—Class I and II
Chicago, Ill.
Crouse-Hinds Co.—Class I and II
Syracuse, N. Y.
Killark Electric Mfg. Co.—Class I
St. Louis, Mo.
Leland Electric Co.—Class I
Dayton, Ohio
Pyle-National Co.—Class I and II
Chicago, Ill.
Ralco Mfg. Co.—Class I and II
Chicago, Ill.

Fixtures & Fittings

Appleton Electric Co.—Class I and II
Chicago, Ill.
Benjamin Electric Mfg. Co.—Class I and II
Des Plaines, Ill.
Crouse-Hinds Co.—Class I and II
Syracuse, N. Y.
Holophone Co., Inc.—Class II
New York, N. Y.
Russell & Stoll Co., Inc.—Class I
New York, N. Y.
Wheeler Reflector Co.—Class I and II
Boston, Mass.

Portable Cable Reels

Appleton Electric Co.—Class I and II
Chicago, Ill.

Flashlights & Lanterns

Economy Electric Lantern Co., Inc.—Class I
Chicago, Ill.
National Carbon Co., Inc.—Class I
New York, N. Y.

Motors

Allis Chalmers Mfg. Co.—Class I and II
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Armor Electric Mfg. Co.—Class I and II
Erie, Pa.
Baldor Electric Co.—Class I
St. Louis, Mo.
Brown-Brockmeyer Co., Inc.—Class I
Dayton, Ohio
Century Electric Co.—Class I and II
St. Louis, Mo.
Continental Electric Co.—Class I
Newark, N. J.
Emerson Electric Mfg. Co.—Class I
St. Louis, Mo.
Fairbanks, Morse & Co.—Class II
Chicago, Ill.
General Electric Co.—Class I and II
Schenectady, N. Y.
Howell Electric Motors Co.—Class I and II
Howell, Mich.
Idnal Electric & Mfg. Co.—Class I and II
Mansfield, Ohio
Imperial Electric Co.—Class I
Akron, Ohio
Janette Mfg. Co.—Class I
Chicago, Ill.

Leland Electric Co.—Class I and II
Dayton, Ohio
Louis Allis Co.—Class I and II
Milwaukee, Wis.
Marathon Electric Mfg. Corp.—Class I
Wausau, Wis.
Master Electric Co.—Class I and II
Dayton, Ohio
Reliance Electric & Engineering Co.—Class I
Cleveland, Ohio
Robbins & Meyers—Class I
Springfield, Ohio
U. S. Electrical Motors, Inc.—Class I and II
Los Angeles, Cal.
Wagner Electric Corp.—Class I and II
St. Louis, Mo.
Westinghouse Electric & Mfg. Co.—Class I and II
East Pittsburgh, Pa.

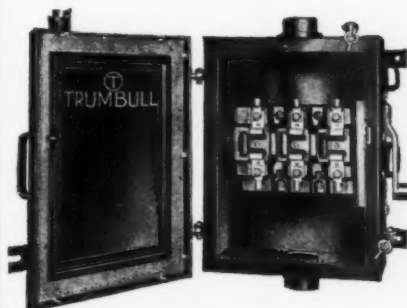
Motor Controls

Allen-Bradley Co.—Class I and II
Milwaukee, Wis.
Appleton Electric Co.—Class I and II
Chicago, Ill.
Arrow-Hart & Hegeman Electric Co.—Class I and II
Hartford, Conn.
Colt's Patent Fire Arms Mfg. Co.—Class I and II
Hartford, Conn.
Cutler-Hammer, Inc.—Class I and II
Milwaukee, Wis.
General Electric Co.—Class I and II
Schenectady, N. Y.

FOR HAZARDOUS LOCATIONS



TRUMBULL Heavy Duty Switches



In Dust-Tight, Water and Weather - Proof Heavy Gauge, Gasketed Boxes—listed and approved by Underwriters for Class II (groups F&G) — Class III and IV.

30-200 amp. — 3 Pole Fuse—Single and Double Throw.

Quick Make and Quick Break—Interlocking Cover—Rated in Horse Power—Rust resisting finish.

Listed and described in Bulletin No. 135.

THE TRUMBULL ELECTRIC MFG. CO.

A GENERAL ELECTRIC ORGANIZATION

PLAINVILLE


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**THE INSTALLATION WILL
REQUIRE
EXPLOSION-PROOF
FITTINGS**



MR. CUSTOMER

**I'LL USE
KILLARK
THEN YOU'LL NEVER
HAVE TO WORRY...**



MR. CONTRACTOR



GRS



GESMU



GECME



GEUE



EYMF
Combination Capped
Elbow and Sealing Fitting

For Hazardous Locations



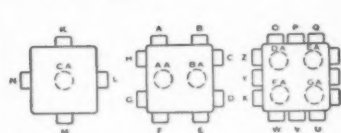
Electrical wiring in hazardous locations calls for special fittings to minimize the dangers from explosion and fire, always a menace to life and property.

Contractors who have had experience with Killark explosion-proof fittings are confident when the call comes—they can estimate with absolute safety because they know the ease with which these fittings are installed.

Killark Electrolets are made in a complete range of sizes and styles for every requirement, including hub combinations up to 2 inches. Listed as standard by Underwriters' Laboratories for Class I Group D locations. New short length approved unions. Every hub combination available. Send for new bulletin.



GRD WITH VARIOUS HUB COMBINATIONS 1/2 TO 2 INCH



UF



UM



SEALING
FITTING

KILLARK ELEC. MFG. CO.
3940 EASTON AVENUE, ST. LOUIS, MO.

**What to Buy And
Who Makes It** [FROM PAGE 37]

Motor Controls [Continued]

Louis Allis Co.—Class I
Milwaukee, Wis.
Rowan Controller Co.—Class I
Baltimore, Md.
Russell & Stoll Co., Inc.—Class I and II
New York, N. Y.
Sharpville Boiler Works Co.—Class I
Sharpville, Pa.
Square D Company—Class I and II
Detroit, Mich.
Trumbull Electric Mfg. Co.—Class II
Plainville, Conn.
Westinghouse Electric & Mfg. Co.—
Class I and II
East Pittsburgh, Pa.

Outlet Boxes & Fittings

Adalet Mfg. Co.—Class I
Cleveland, Ohio.
Adapti Co.—Class I
Cleveland, Ohio
Appleton Electric Co.—Class I and II
Chicago, Ill.
Crouse-Hinds Co.—Class I and II
Syracuse, N. Y.
Killark Electric Mfg. Co.—Class I
St. Louis, Mo.
Pyle-National Co.—Class I and II
Chicago, Ill.
Ralco Mfg. Co.—Class I and II
Chicago, Ill.
Russell & Stoll Co., Inc.—Class I
New York, N. Y.

Panelboards

Appleton Electric Co.—Class I and II
Chicago, Ill.
Benjamin Electric Mfg. Co.—Class II
Des Plaines, Ill.
Crouse-Hinds Co.—Class I and II
Syracuse, N. Y.

Receptacles

Appleton Electric Co.—Class I and II
Chicago, Ill.
Crouse-Hinds Co.—Class I and II
Syracuse, N. Y.
Pyle-National Co.—Class I and II
Chicago, Ill.
Ralco Mfg. Co.—Class I and II
Chicago, Ill.

Switches, Enclosed

Cutler-Hammer, Inc.—Class I and II
Milwaukee, Wis.
Square D Company—Class I and II
Detroit, Mich.
Trumbull Electric Mfg. Co.—Class II
Plainville, Conn.

Switches, Snap

Appleton Electric Co.—Class I and II
Chicago, Ill.
Crouse-Hinds Co.—Class I and II
Syracuse, N. Y.
Killark Electric Mfg. Co.—Class I
St. Louis, Mo.
Leland Electric Co.—Class I
Dayton, Ohio.
Master Electric Co.—Class I
Dayton, Ohio.
Pyle-National Co.—Class I and II
Chicago, Ill.
Russell & Stoll Co., Inc.—Class I
New York, N. Y.

Wiring For Research

[FROM PAGE 10]

liberal size, this extra precaution in cabinet sizes, safeguards against the need for expensive additions later on.

To provide the laboratories with 125 and 250-volt direct current required an extensive system of d.c. feeder circuits between the generator switch-board and plugging panel and smaller but similar plugging panels, at the five riser points on each laboratory floor. These circuits may be plugged in at the switch-board to one of several circuit breakers, according to the amount of over-current protection or loading limitation desired.

SOME MATERIALS NEEDED IN THE INSTITUTE

1/2-in. to 1-in. conduit.....	158,500 ft.
1 1/4-in. to 2-in. conduit.....	20,300 ft.
2 1/2-in. conduit.....	13,000 ft.
3-in. to 5-in. conduit.....	20,640 ft.
No. 16 to No. 10 wire.....	436,700 ft.
No. 8 to No. 2 wire.....	122,025 ft.
No. 1/0 to No. 4/0 wire.....	17,500 ft.
300,000 C. M. wire.....	53,000 ft.

There are also many features of design, worked out to make the use of electrical service convenient for research—outlets where they should be and switch controls carefully located. For example, the switch at every room entrance combines also a waist-high plug receptacle. Where two or more switches are ganged, the top switch in all tandem plates, or the one next to the door trim, in horizontal plates, always controls the lights nearest.

The many washrooms in the Institute have heavy-duty circuits, and several outlets, for electric driers, although their use has not been generally adopted in the building. To keep from pulling vacuum cleaner cord plugs out of corridor receptacles, the plates have a metal yoke for attaching a hook, fastened to the cleaner cord. Just in case the building superintendent uses both single-phase and 3-phase motors, each corridor outlet has two receptacles, one being polarized for 3-phase.

Here then is an example of research applied to wiring that has been designed for use for many years. It will serve these industrial scientists adequately for a long while, although their future electrical needs are hardly known. For with the new Institute building, acclaimed as the world's finest, they would not risk the possibility of obstruction to expanding research, for lack of wire capacity.



The welds won't open under the most severe bending

STEELDUCT RIGID CONDUIT

ALL STEELDUCT conduit is made from mild, easy-bending steel, with welds that will not open under the most severe bending. THREADS are protected against damage during shipment. STEELDUCT Conduit meets all underwriters' requirements.

A COMPLETE LINE OF RIGID STEEL CONDUIT

ELECTRO-GALVANIZED

HOT-DIP GALVANIZED

BLACK ENAMELED

AND

Electrical Metallic Tubing

The **STEELDUCT** *Company*
YOUNGSTOWN · OHIO

*An Answer to the Demand
for a Non-Tamperable Fuse!*

The FUSTAT

RESISTS TAMPERING AND OVER-FUSEING

Pennies or slugs cannot be used to bridge the Fustat. But that alone would not stop the foolish from sidetracking protection. Hence . . .

The Fustat has no shell to strip back—tin foil or lamp cord strands are torn away by insulated metal cutters when Fustat is inserted. With any material, **EASY TAMPERING IS IMPOSSIBLE.**

and

OVER-FUSEING IS PREVENTED. A 20 or 30 ampere Fustat will not fit in a 15 ampere receptacle or adapter. Similar limitations apply to all other sizes.

But that's not enough

A non-tamperable fuse that would blow on starting currents would be an impractical device—a terrible nuisance—So the Fustat . .

WIPES OUT ANY EXCUSE FOR TAMPERING BECAUSE IT STOPS NEEDLESS BLOWING

Tampering is often the result of fuses blowing when washing machines and other appliances are started.

With 10 amperes flowing in an ordinary circuit, you can throw on a 5 ampere split phase motor—and a 15 ampere Fustat *will hold it*. Loading the circuit to capacity doesn't bother the Fustat.

It gives **SAFE PROTECTION** without **USELESS SHUT-DOWNS, and yet**

Protects Flexible Cords Against Burnout —in Spite of its Long Time-Lag

The Fustat contains a fuse. The ability of a fuse to protect against dangerous cord shorts or grounded sockets is well known. The only protective device that opens as quickly on short-circuits as the fuse is the **MAGNETIC** type circuit breaker.

A 15 ampere Fustat, in spite of its long time-lag on 40 or 50 amperes, operates on short-circuit just like a fuse. Hence, when cords get shorted or sockets are grounded, the Fustat prevents spraying of molten metal, starting of fires, burning of users, etc.

It **HOLDS** like a **LARGE** fuse when safety **PERMITS**, yet **OPENS** like a **SMALL** fuse when safety **DEMANDS**.



MORE THAN A FUSE

- **Makes SAFE Protection REMAIN SAFE**
- **Stops loss of money on needless "blown-fuse" service calls**
- **Permits adding more appliances to present circuits**

FUSTATS CAN BE USED
IN OLD INSTALLATIONS
AND READILY
INSTALLED ON NEW JOBS



Adapter
Price \$0.07 1/4

Insert the Fustat in this adapter, then screw into any receptacle on any fuse block, panel board or switch.

The adapter locks itself in place—can't be removed without destroying it. Steel spur, like a ratchet, lets adapter screw in but not out. The Fustat can be changed in the ordinary manner.

On new jobs, when buying panels, switches, etc., you can specify that they be equipped with Fustat bases.

	FUSTATS	ADAPTERS
15 Amp.	No. 915	A15
20 Amp.	920	A20
25 Amp.	925	A30
30 Amp.	930	A30

A15 adapters won't take 20, 25, or 30 amp.
A20 adapters won't take 15, 25 or 30 amp.
A30 adapters won't take 15 amp.

0 to 14 ampere sizes (for motor protection) also obtainable—write for full information.

Every service man knows that 15 ampere fuses frequently blow when washing machines, refrigerators, oil burners and other motor driven devices start.

Every appliance dealer knows that such needless blows require many useless service calls—just to replace a fuse.

Every Central Station knows every useless shutdown causes loss of revenue and worse still, loss of confidence in things electrical.

and *Everyone in the electrical industry* will readily admit that something must be done to stop such

blows—but it must be done without loss of safety.

Certainly we can't afford to have flexible cords flame up when shorted, just to meet the problem.

Isn't it clear therefore, that the modern protective device:

must RESIST tampering and over-fusing.

must OPEN QUICKLY on short-circuits or other dangerous overloads.

but

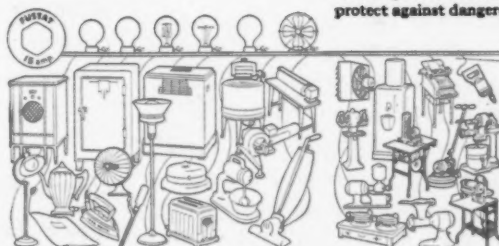
must NOT OPEN on motor starting currents or other harmless overloads.

and isn't it clear that...

TODAY'S CIRCUITS DEMAND FUSTATS

For what device other than a Fustat can—make SAFE protection REMAIN SAFE... Positively protect against dangerous cord shorts as well as overloads... and Eliminate needless blows.

and all at a
RETAIL
PRICE
OF ONLY
7 1/2¢



WRITE FOR FULL INFORMATION TO ANY OF THE UNDERSIGNED

BUSSMANN MFG. CO.
Division of McGraw Electric Company
University at Jefferson
St. Louis, Mo.

KIRKMAN ENGINEERING CORP.
121 Sixth Ave.
New York, N. Y.

NATIONAL ELECTRIC PRODUCTS CORP.
Fulton Building
Pittsburgh, Pa.

July EDITORIALS

Earl Whitehorne Editor

When Science Specifies Wiring

If a "job of the year" was to be selected as an example of the best in planned wiring systems, Pittsburgh's new Mellon Institute of Industrial Research would rank high among 1937 accomplishments. The story of this installation, is presented elsewhere in this issue. Behind the job lie years of planning to make this magnificent "Temple of Science" electrically complete, with adequate provision for future development.

There is a lesson in it. For other engineer-contractors can also sit in with their local architects, engineers and building committees. They, too, can stress the same principles that guided in planning the Institute to provide for many years ahead in the full use of electric service. Because of deficient wiring, many good structures must be mutilated at heavy cost, after short periods of occupancy. This would have been poor economy in the Institute, so a wise investment was made in the beginning. It can be done in other buildings.

Keep The Goose Laying Gold Eggs

Motor shop management is being invited here and there to engage in the new American industrial pastime—collective bargaining. In it both parties must meet the time-worn issue—shall they kill the goose that lays the golden egg or keep it healthy?

The motor shop industry is already faced with a challenging economic competition. Repairs cannot cost more than motor replacement, for beyond that price level a high percentage of motor reconditioning work will cease to be. Shop volume will dip, when new equipment can be bought at prices ranging even somewhere near the charge for reconditioning old apparatus.

No one can deny the right of labor to bargain collectively, seeking the highest obtainable wage. But labor as well as management is involved in the consequences

of cost. Both parties to the bargaining must keep an eye on the price of new equipment in mass production or both will suffer heavily.

Nor should shop employment be compared with jobs in the construction crafts on the mere basis of daily wages. Motor shops have a stability usually not shared in construction work. But steady year-round employment can be maintained for the workers, in some four thousand private repair shops, only when a fair margin obtains between the cost of repairs and the cost of replacement.

Once let repairs get out of balance with new products and no kind of bargaining can save the motor shop from degenerating to a mere business of emergency tinkering. And the time to talk this over with the men is now—before the bargaining starts.

Let's Be Generous With Ourselves

When you stop to consider, it is shocking that the service of the electrical industry to the American people has been established on a mere minimum safety standard. The insurance companies said—"Anything less than this is hazardous". But electrical men adopted this minimum as a standard of adequacy.

So today the use of electricity for all purposes is regulated by a wire capacity that was selected only as a basis for preventing fires. And the inspector, who polices wiring for safety only, is made the sole authority on what capacity is needed. In other words, we feed the baby any food that won't burn its tongue. Why bother about quality, quantity or digestion?

Electrical energy is not a commodity. It is a service. People only want it because it does things for them. Its usefulness and value depends not on what it is, but on where it is available and how much it will do. It is about time we quit selling it and installing it on the smallest scale that is safe. Let's be a bit more generous with our customers—and with ourselves. Let's start installing plenty of capacity and plenty of outlets—everywhere. It is just a matter of selling.

Apprentice Training— Face The Problem

There is an old saying—"Never trouble trouble, till trouble troubles you". But it is bad advice, because when trouble really comes along, human nature won't admit it. We just say, "Why there's my old friend Trouble again. But I'm sure he's not looking for me."

So we wait around until he puts the heat on us—and we, without an ice cube in our pockets. Take this matter of apprentices, for instance—

It has been ten years since contractors have trained any youngsters to install wiring. Helpers today are scarce as dodo birds. And journeymen now average near fifty years of age. Meanwhile, the biggest volume of wiring ever known in the industry is staring us in the face. All we need do is go and get it. But who will do the work?

The Union says there is no shortage of electrical workers. It is probably right, for unemployed wiremen are available in many cities. But these are mostly old men, and sad though it may be, employers do not hire them, do not want them. The contractor naturally selects vigorous young men or seasoned workers, still in their prime. The present system does not provide a lower wage for the less productive work that these old boys should now be doing.

In 1947 the average age of the journeymen, now on the job, will be sixty. And sixty sounds serious, when you think of the kind of work these men must do. So it is time to tackle the problem, because it will take five years to formulate a plan and get it going and train new men to skill and responsibility. Knowledge cannot be administered in capsules. And all the time we will be running further behind and five more years on top of that will not be enough to catch up much.

The apprenticeship plan appears to offer the only adequate and permanent relief. It has been proven practical in this and other trades in many cities. Government stands ready to lend financial aid in such vocational education. Labor will cooperate, is cooperating in Chicago and Detroit. But the need is too urgent for just a few cities to cope with. The need is national and must have a nation wide solution. Every employer of electrical workers is involved and should aid in setting up a well organized program for permanent apprentice training.

This trouble will not pass on. It will grow worse, until the industry corrects it by constructive action. Almost nothing is being done about it. What do you think about that?

Who Wants This Job?

Only about ten years ago the neon tube was lighting up Main Street with a new splash of color. The public liked it. Today every hamlet has its quota of gaseous tube signs and decorations.

But, in the roaring twenties, the electrical contractor was either too busy, or too short on imagination to

see the future of the bright hued tubes. Another industry kindly took over the grief of this uncertain new venture—and the profits. That is all over the dam, but history is getting ready to repeat itself some more—if we want it to.

Sodium vapor highway lighting has now come along with strong popular appeal. High intensity mercury vapor lamps are breaking into many industries, setting new standards of lighting intensity. The manufacturers have done a good job laying the ground work. It takes little imagination to see the future. Yet nowhere, with rare exceptions, has the contractor stepped into this field.

Here is a dramatic, radically new type of lighting. A broad field of application is indicated. Someone is going to profit in a big way with this sodium and mercury vapor equipment and the developments that are bound to follow. It is going to need brains and enthusiasm and good selling. The electrical contractor must take on the job—or watch some other industry grow on it in his own backyard.

And What Is Your Answer?

They told Columbus it couldn't be done. But he came over. A lot of people laughed at Ford's horseless carriage. And plenty of contractors believe they cannot wire houses at a profit. But with twenty-two million old homes waiting and two million new ones coming, somebody is going to find the way.

Present inadequacy of circuits in factories, stores, offices and houses is such a menace to the further progress of the electrical industry that something is going to happen soon. The first step is to forget our old ideas of what is possible. The point is—How can we change our methods of selling and installing, so the trick can be turned?

Maybe that means wiring houses a hundred at a time. Maybe it means a new approach to commercial and industrial buildings, with instruments and a proposition based on savings. Maybe it means some other things that nobody has yet thought of. But the problem must be faced and the job has got to be done—and if it works! —“OK!”

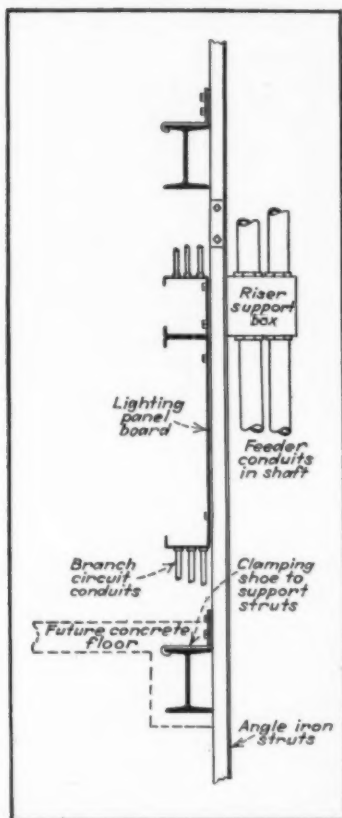
What is your answer? Have you tried to find out?



Methods of other CONTRACTORS

PANEL SUPPORTS CLAMP TO STEEL

Steel workers claimed the job of erecting steel supporting struts for cabinets in a building that was being wired by the Hatfield Electric Company of



STEEL WORKERS FOILED—Supports for cabinets erected in building without drilling the steel frame.

Cleveland, so a supporting method was worked out which avoided drilling the structural steel, thus breaking the steel worker's claim.

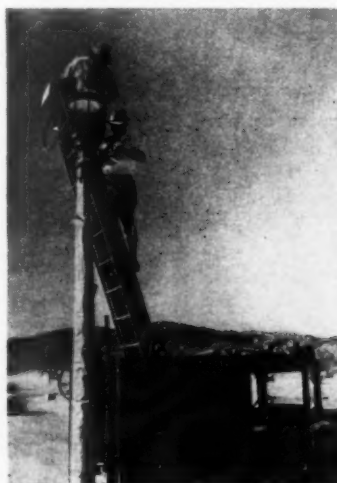
The pairs of 1½-in. angle iron which extended vertically from floor to floor at the pipe shaft were provided with

flat iron shoes that rested on steel beams or soffits at each floor. Hooked ends engaged the beam flange, thus permitting the struts to be drawn tight after a section was made plumb. Panelboard cabinets and riser cable supporting boxes were secured to these struts for receiving the feeder and branch circuit conduits.

FIELD SHOP ON WHEELS

Trucks can serve as the contractor's field shop. An interesting example is a special truck designed and built by the Globe Electric Works, San Francisco, to use in street lighting installation work and for adjustment and servicing of lamps and lighting equipment at oil service stations. It has also proved handy in light pole line construction.

The body of this small truck has two cabinets, one on each side, with a space in the middle in which a 40-ft. telescoping ladder is mounted, on angle iron. The cabinets have doors which fold downward and contain tools, materials, fittings and field equipment.



ON THE JOB—Globe Electric's field shop-truck in action with ladder telescoped down.

The top of the cabinet is wide enough for a workman to stand on.

The ladder itself is the most ingenious feature. It has rungs on both of its faces and the telescoping section slides down between the parallel rows of rungs. It can be adjusted to any angle and when not in use, folds back over and across the top of the truck.

Ingenious service features of this ladder include a metal tool basket at



LADDER EXTENDED—Note safety strap and self levelling tool basket at top, also standing room on cabinets.

the top, which hinges freely and maintains a horizontal position. Below is a small platform which folds out and can be used to stand on, if the ladder is in a vertical position. A heavy metal loop around the top of the ladder acts as a safety strap. The truck is small but has ample space for carrying other material. It has short wheel base, and is able to get into places where ordinary equipment would be difficult to move.

MODERNIZED OVERHEAD FEEDERS

Adequate provisions for an increased power load, were installed during the enlargement of a Chattanooga, Tenn., pipe foundry. New sets of 500,000 c.m. overhead feeders were run from this steel tower to various outlying buildings.

In wiring this plant, the Terrell Electric Company installed the top gang of feeders first. Two steel cross arms are provided at the top of this tower for bolting on strain insulators. The feeders that are to make up the lower group had not yet been strung when this photograph was taken.

The building behind the tower is the old engine room that will contain a new 50-ft. main distribution switchboard with a 600-amp. primary and

Electrical Contracting, July 1937

SIX REASONS WHY YOU SHOULD USE GENERAL ELECTRIC TAPES



FRICITION TAPES No. 360, 361, AND 371 — RUBBER TAPE No. 362

SELECTIVITY

A complete line of superior friction tapes and rubber tapes from which you can select those that meet your particular requirements.

PERMANENT ADHESION

G-E Friction Tapes will not dry up or ravel. They maintain their excellent adhesive qualities and stick tenaciously.

DEPENDABLE

G-E Tapes which you buy are the same as those used by General Electric.

MOLDABILITY

G-E Rubber Tapes can be molded by the heat of your hand into a water-tight insulated joint.

ADDED VALUE

G-E High-quality Tapes cost no more than ordinary tapes.

EXTRA PROFITS

You can rely on G-E Tapes to do a perfect job that will help build your reputation as an outstanding contractor and ultimately increase your sales and profits.



GENERAL ELECTRIC

INSULATING
MATERIALS

For information on G-E Tapes, see your G-E Merchandise Distributor, or write Section M-887, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

APPLIANCE AND MERCHANDISE DEPT.
GENERAL ELECTRIC COMPANY
BRIDGEPORT, CONNECTICUT

GREENLEE

PROFIT MAKERS For The Contractor



THE greater the efficiency of the tools you use, the more chance you have of meeting competition and making a profit on each job. That is why Greenlee Conduit Benders and Knockout Tools are so popular. They cut costs on every job and are liked by the men who use them.

Hydraulic Conduit Benders

Greenlee Hydraulic Conduit Benders insure profits, because they bend conduit quicker and easier than by other methods. In addition, they make smooth, even bends, eliminating many fittings and making it easy to pull in wire and cable. They are easy to take to the job, too, because they are readily portable.



Knockout Tools

Greenlee Knockout Punches and Cutters are time savers and profit makers, because they make it easy to enlarge holes in switch boxes, cabinets, etc. They form clean-cut holes quickly and accurately, without reaming or filing.

OTHER TOOLS: Hydraulic Pipe Pushers, Ball-Bearing Joist Borer, Electrician's Bits, Bit Extensions

GREENLEE TOOL CO. ROCKFORD ILLINOIS

GREENLEE TOOL CO., Rockford, Ill.

Please send complete information on the following:

☐ Knockout Tools ☐ Conduit Benders

Name.....

Street.....

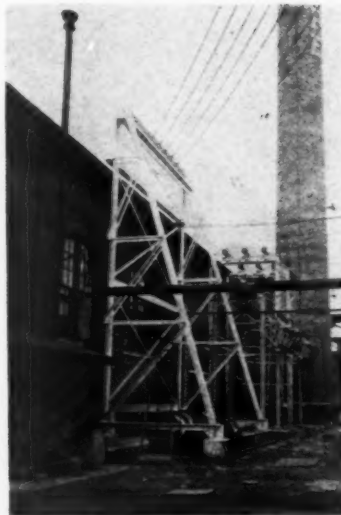
City.....

State.....

My Jobber is..... 7-37

Methods of other CONTRACTORS

[FROM PAGE 50]



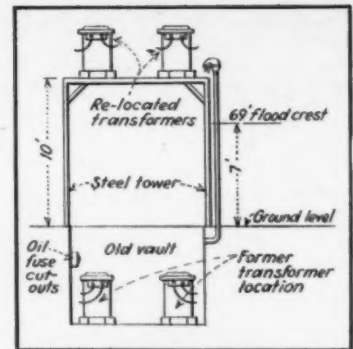
NEW OVERHEAD—Modern steel tower for heavy overhead feeder spans that supply enlarged pipe foundry.

3000-amp. secondary main breakers on it. Old generators were dismantled, giving way to a transformer station (in background) comprising three 333-kva. and three 200-kva. units.

FLOOD RELIEF

The cost to recondition various 4,000-volt, 75-kva., transformers as a result of the Ohio Valley flood was high for the Marshall College of Huntington, W. Va. Beckmeyer-Davis Company is now trying to safeguard them from future trouble at several load centers on the college grounds.

Hot-dipped galvanized steel towers or racks were set in concrete footings over the present transformer pits or vaults. These towers are 10 ft. high, whereas



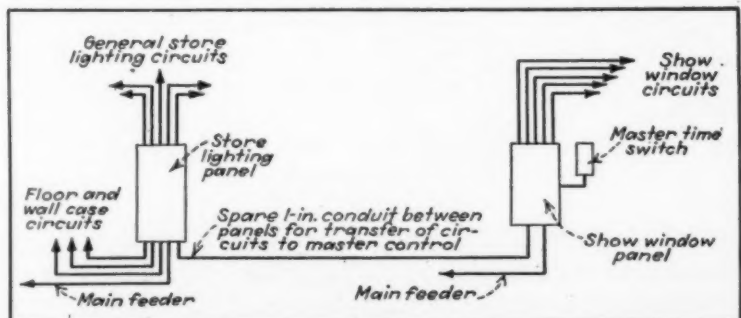
ELEVATED KETTLES—Steel frame supports transformers formerly located in pit, at an elevation well above record flood crest.

the record flood crest of 69 ft. was but 7 ft. above the campus ground level. The wiring connections are being extended up to the new high-and-dry transformer locations, so there is no longer a flood menace for the transformer at this college.

CIRCUIT REGROUPING MADE EASY

After a store has been remodelled, it is sometimes found desirable to transfer or re-group certain lighting circuits from panelboard switching to automatic time clock control. To permit such changes to be easily made in a recently rewired shoe store, the General Wiring Company of Youngstown, Ohio, provided a spare 1-in. conduit between the general store lighting panelboard and the clock-switched show window lighting panelboard.

Spare circuit connections were provided in the window panel. Any store circuits, for several main lighting fixtures, show cases, or special spots, can at any future time be extended through the spare conduit and connected to these spare clock-controlled circuits. Thus it will not be necessary to run exposed wiring for making such changes after the store equipment and decorations are finished.



HANDY RACEWAY—Spare conduit connects between panels, for changing circuits from manual to clock switching.

ALCOA ALUMINUM BUS *for Power in your Mills*

Alcoa Aluminum Bus used for feeder on plate and hot strip mills in a large mid-western steel plant.

There are three major factors to consider in providing the conductor that feeds electrical equipment in your plant:

Layout: Putting bus bar out of the way, preferably overhead, conserves valuable space and reduces hazard. Alcoa Aluminum Bus is light and strong, easy to place overhead with economical disposition of supports.

Installation: Alcoa Aluminum Bus is easily formed. Joints can be made by welding, bolting or clamping without difficulty, and it requires only simple, inexpensive fittings.

Efficiency: Properly installed runs of Alcoa Aluminum Bus have given service for twenty years and more without attention. Aluminum's natural resistance to corrosion suits it to conditions where corrosive gases and fumes prevail.

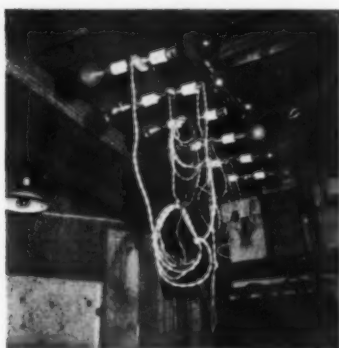
Besides the flat Alcoa Aluminum Bus illustrated, you may want the tubular form, or Channeluminum, the rolled channel section. Channeluminum has high structural strength plus good electrical and thermal efficiency. ALUMINUM COMPANY OF AMERICA, 2197 Gulf Building, Pittsburgh, Pennsylvania.



Among the MOTOR SHOPS

OVERHEAD TEST BANK

For loading small motor-generators and converters for test runs, the Reserve Electric Company, of Cleveland, has rigged an overhead rack of wired sockets with flexible leads that reach to the testing bench. The sockets are connected in multiple pairs to six two-conductor No. 12 reinforced cords. Lamps ranging from 1,000 watts down to 200 watts are used in various voltage combinations to provide whatever arti-



TEST LOADS—Overhead sockets with flexible leads connect small generators on test bench.

ficial load is needed for the rating of the machine that is to be tested.

After a small converter for neon signs, or similar equipment has been reconditioned, a pair of flexible wires connecting the correct wattage rating is selected from the overload rack. These wires are connected to the generator leads, while the motor end of the machine is plugged in to outlets on the test bench.

YARD STORAGE SIMPLIFIED

An outdoor monorail system aids in storing and handling heavy equipment at the newly completed plant of the Electric Motor Repair Company of Raleigh, N. C. Here a concrete paved



AERIAL HAULING—Outdoor monorail helps store transformers in service shop's concreted yard.

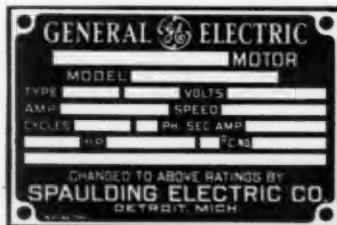
storage yard for transformers and other heavy apparatus has been equipped with an A-frame monorail supporting structure that is 45 ft. in length.

Every 15 ft., 11 ft. high, there are sets of 3-in. by 5-in. A-frame I-beams which are spread 57 in. apart at the ground and 36 in. wide at the top. Equipment is brought by monorail from within the shop to sliding doors at the right, and picked up at that point and moved without effort to the proper storage aisle in the yard.

NAME PLATE FOR CHANGED RATINGS

When the Spaulding Electric Company, of Detroit, re-builds a motor, a new name plate is placed near the original one, telling the owner just how extensive the face-lifting operation may have been. There is no guessing about the machine's old rating.

To make these name plates, this company installed a special motorized etch-



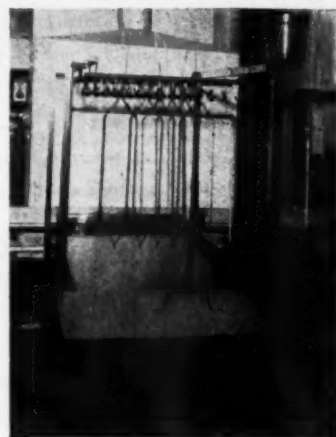
NO MYSTERIES—Rebuilt motors receive new name plates alongside the original ones to give complete "before-and-after" data.

ing machine that puts the new data on the blank plate plainly and in neat alignment. As a result, the customer gets a motor that is identified in a manner in keeping with the finished general appearance of this shop's output.

CONTROL VARNISH DRIPPAGE

After large coils have been impregnated, some of the excess varnish that drains off can be salvaged, and the floors can also be spared of becoming gummed up. In the remodelled service shops of the H. N. Crowder, Jr. Company at Allentown, Pa., a new outfit was made up for this purpose. This consists of a sheet steel vat, an angle iron coil rack and a steel drip pan that drains the varnish back into the vat.

The new varnish vat is 15 in. by 32 in., and 30 in. high. It has a close-fitting cover with a man-sized handle for convenience in lifting the lid. This



NO WASTE—Compact varnish vat and coil rack keeps varnish waste under control and off the floor.

drain pan is 30 in. wide, 44 in. long with three sides raised $2\frac{1}{2}$ in. The frame is 26 in. wide and 66 in. high, made of 1-in. by 1-in. angle iron. Flat iron X-braces were provided near the base for stiffening the rack. Pipe cross bars, each with eleven J-hooks bolted through them, permit a large number of coils being hung on for preheating, dipping, draining and final baking.

PRICING ROTOR WELDS

For estimating the price for welding rotors, the Wm. C. Krauth Electric Company of Louisville charges \$1.35 per inch of rotor diameter for each end to be welded. This system is reported

Electrical Contracting, July 1937

IN ALL THE WORLD

NO FINER

ELECTRICAL
EQUIPMENT

BULL DOG

Vacu-Break

SAFETY SWITCHES

**Meet Every Modern Requirement for
SAFETY, EFFICIENCY and APPEARANCE**

All the desirable, modern features are found in Bull Dog VACU-BREAK Safety Switches—stylined compact Cabinets . . . all arcing Doubly Sealed for extreme Safety Switching . . . SOLDERLESS WIRE GRIPS for utmost ease of installation. Bull Dog VACU-BREAK Safety Switches are definitely the safest, most efficient, most modern ever designed.

Above—Left, "CSX" Type
Toggle Switches and Plug
or Cartridge Fuse, 4 to 40
Circuits.

Above—Right, "PS" Type
Plug Fuse & Toggle Switches,
4, 8 and 12 Circuits.

Right, The Space-saving
Narrow Column Type Switch
Center.

**BULL DOG
SWITCH
CENTERS**

A new, ornamental and
economical line of lighting
Panelboards for use in fac-
tories, garages, warehouses
and similar buildings. This
line includes the space-sav-
ing NARROW COLUMN type
for installation on columns
or pilasters in industrial plants
and commercial buildings.

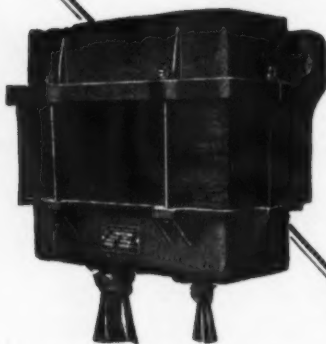


BULL DOG ELECTRIC PRODUCTS COMPANY

BULL DOG ELECTRIC PRODUCTS OF
CANADA, LTD. TORONTO, ONT.

DETROIT, MICHIGAN

If you use TRANSFORMERS you will be interested in latest developments by AMERTRAN



Type CFT three-phase, outdoor-type, air-cooled transformer

Types CF and CFT

- Air-cooled—no oil nor fireproof vault.
- Conduit Fittings—easy to install.
- Single-Phase or Three-Phase types.

AmerTran Air-Cooled Transformers and Auto-Transformers reduce operating costs . . . they may be used on single- or three-phase circuits for supplying 115/230 volts for lighting or power from 230-, 460-, 575-, or 2300-volt power circuits so that advantage may be taken of the lower power rates. Other standard types are furnished for phase-changing, voltage boosting and operating low-voltage equipment. AmerTran is also prepared to furnish many other types of transformers, including types for distribution, power, testing, welding, etc. May we have the opportunity to send information on equipment to meet your requirements?



Type CF single-phase, outdoor-type, air-cooled transformer



**American
Transformer
Company**

**160 Emmet Street
Newark, N. J.**

Among the **MOTOR SHOPS**

[FROM PAGE 54]

to work out satisfactorily, under an arrangement with an outside welding firm, that does this work for 80 cents per inch-diameter for this shop.

According to a report made at the N.I.S.A. Convention, a recent questionnaire to the membership indicated a variation in charges for such work ranging from 70 cents to \$1.50 per inch-diameter.

FOUR-IN-ONE SHOP RECORD

In line with the trend toward simplified work records the Armature Winding Company of Charlotte, N. C., uses an 8½-in. by 11-in. stiff paper card record which combines receiving, shipping and work data and material costs

on one form. In addition to equipment description this form has spaces on front for rewinding details, and for diagramming the type of coil construction. Space is provided for inserting information about trip coils and auto transformers.

The reverse of this form has spaces for the original data of transformers, and also for recording the data as rewound. Seven full-width ruled lines are reserved for entering a detailed description of the repairs made. For listing and costing materials, there are thirty reminder items already printed and ready for writing the quantities actually used. These items cover magnet wire, insulating papers, tapes, varnishes, terminal leads, etc. Ten full-width lines are left blank for labor entries and special materials. An allowance for waste of 10 per cent is printed in so as not to be overlooked in striking off the total cost.

The heavy black line down the center of the card is creased for the convenience of shop employees. It folds into a narrow, easy-to-handle shape.

JOB No.	MATERIAL AND	DATA SHEET	S. G. No.
Customer Name:		Ship to:	
Address:		Address:	
Received Via:		Via:	Date:
Date:	Order No.:	Ship with:	
Make:		Rewind for:	H.P.: KVA
H.P.:	KVA:	Volts:	Volts:
RPM:	Phase:	Cycles:	Phase: Cycles: RPM: Amp.:
Amp.:	Type:	Form:	Apparent Cause of Trouble:
Frame:	Style or Model:		
Serial:	Description:		
X X Pulley Gear Cdg. Base Rolls Received		Repairs Needed:	
Pulley End on: Side Facing Leads			
Conduit Box Received, Opening			
Leads In Long Shields:			
Short Size: Key way X X			
ORIGINAL STATOR OR ROTOR DATA		STATOR OR ROTOR DATA AS REWOUND	
Connection:	Coils: Turns:	Connection:	Coils: Turns:
Wire Size:	Wound:	Wire Size:	Wound:
Span 1 to:	Sections:	Span 1 to:	Sections:
Slots:	Bore: Net Width Iron:	FORMED COIL DATA	
Coil Extends from Iron:	Length Slot:	Coil Wound:	Wide: High B. Check:
Iron Behind Slot:	Width Slot:	Spread:	Bottom Bar: Top Bar:
Width Tooth:	Depth to Wedge Slot:	Coil Insulation:	
Slot Insulation:			
Division Strips:			
Wedges X X	No. Per Slot:	Coil Dipped:	Times in Clear: Times in Block:
Grouping:		Inside Lead	In Long Outside Lead In Long
DIAMOND COIL DATA			
		AUTO TRANSFORMERS	
TRIP COILS: Overall Length:			
Bore: Cross Section:			
Wire Size: Turns:			
Volts: Amp.: Ohms:			
Leads Brought Out:			

COMPLETE RECORD—One form covers entire repair procedure as employed in a large southern motor service shop.

Electrical Contracting, July 1937

SMOOTH SAILING *to the* PORT OF PROFITS

WHAT YOU NEED

WHEN YOU NEED IT

WHERE YOU NEED IT

FROM ONE SOURCE OF SUPPLY

Westinghouse

Electric Supply Company

The name that means everything in electricity

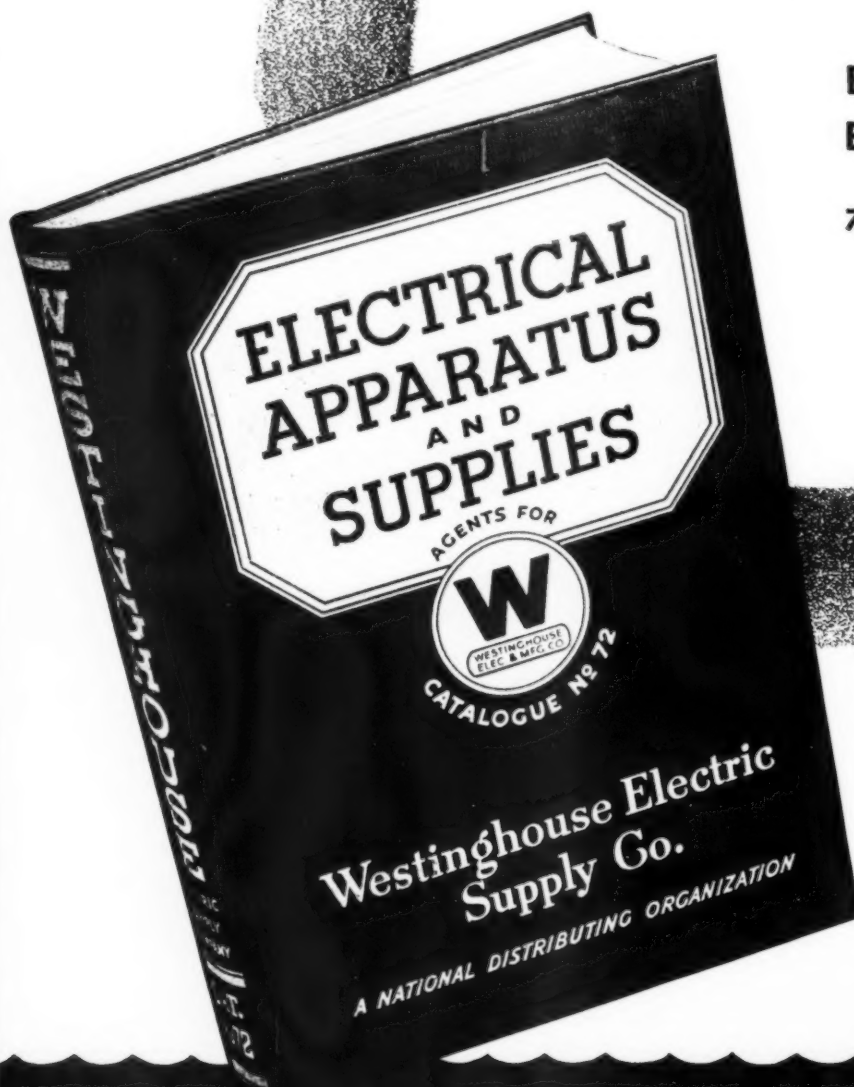
NATIONAL DISTRIBUTING ORGANIZATION WITH 71 BRANCHES

Westinghouse

Electric Supply Company

Let the fair wind of
WESCO cooperation carry you
to the swift completion of every job

EVERYTHING
ELECTRICAL
in stock at
71 local branches



SMOOTH SAILING *to the* PORT OF PROFITS

offers you :



Prompt and efficient delivery service from 71 completely stocked branch warehouses.



Regular and frequent sales contacts. Simplified purchasing. Efficient catalog and price information. Engineering sales assistance.



Complete stocks of many manufacturers assembled at every branch warehouse.



Quality products double guaranteed—Manufacturer and WESCO.



What you need—

When you need it—

Where you need it—

—From one source of supply.

Westinghouse

Wire Capacities *DON'T* S-T-R-E-T-C-H

NOFUZE MULTI-BREAKER LOAD CENTERS

prevent overfusing




Your wiring customers cannot overload circuits protected by a Westinghouse Nofuze Multi-Breaker Load Center. When the capacity of a circuit is reached, they must install new wiring. Because the breakers are calibrated and sealed at the factory, it is practically impossible to "overfuse". That is one reason why it will pay you to install low-cost Westinghouse Nofuze Circuit Protection on every wiring job.

In addition to the greater safety, every customer will want the convenience of Nofuze Circuit Protection. Nofuze Load Centers are equipped with "De-ion" circuit breakers instead of fuses. There is nothing to renew or replace in order to restore service. Simply flip the breaker to "OFF" then to "ON".

Standardize on Westinghouse Nofuze Circuit Protection for every wiring job in homes, beauty shops, filling stations and other commercial buildings. At the new low prices, it costs little, if any, more than switches and fuses. Write today for free catalog. Westinghouse Elec. & Mfg. Co., Dept. 7-N, East Pittsburgh, Pa.

J 60104



Distributed by **WESTINGHOUSE**  **ELECTRIC SUPPLY CO.**

BRANCHES ON
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"SMOOTH SAILING to the PORT OF PROFITS"

69,000 MILES! THIS OLD
BUS SURE DOESN'T OWE ME
ANYTHING!

Westinghouse
motors give
more "mileage" too!

FROM INCOMING LINE TO DRIVEN MACHINE

Specify
Westinghouse



UNDIVIDED RESPONSIBILITY
MULTIPLIES THE VALUE
of
WESTINGHOUSE SERVICE

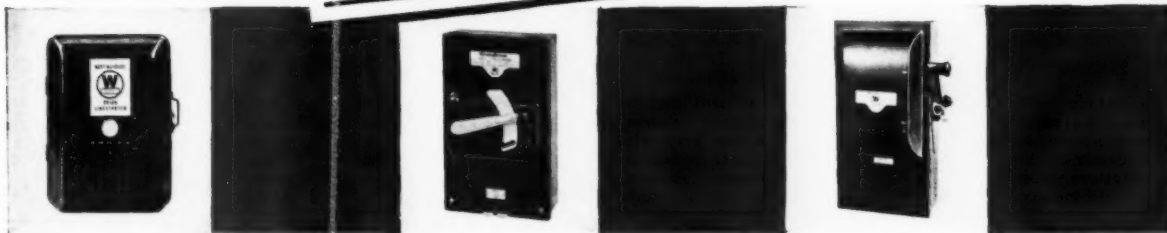
Look for the three most important money-saving mileage features when you have occasion to purchase an electric motor . . . and your choice will invariably rest with Westinghouse. **RIGID ONE-PIECE FRAMES** protect motors against vibration, torque and strain, despite difficult applications. **SEALED SLEEVE BEARINGS** eliminate the biggest cause of motor wear—clean oil is sealed *in*, dust and dirt are sealed *out*. **DUAL-PROTECTED WINDINGS** with *taped end-turns* guard against both *electrical* and *mechanical* damage. For complete information, call or write your nearest:

WESTINGHOUSE OFFICE

ELECTRICAL WHOLESALER

Westinghouse Electric, East Pittsburgh, Pa. J 20319

- Rigid One-Piece FRAMES
- Sealed-Sleeve BEARINGS
- Dual-Protected WINDINGS



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ELECTRIC SUPPLY CO.

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"SMOOTH SAILING to the PORT OF PROFITS"



"DE-ION" LINESTARTERS are available in enclosures to meet standard and special application requirements—also, without enclosures for "built-in" applications.

HOW IT WORKS



Westinghouse

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ELECTRIC SUPPLY CO.

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"SMOOTH SAILING to the PORT OF PROFITS"



IT MEANS COMPACT DESIGN

Banishing of the arc hazard by the "De-ion" principle permits close mounting of Linestarter units or contactors for built-in control applications, with no possibility of "flash-over" to adjacent parts. "De-ion" design also permits compact enclosed starters without sacrifice of accessibility and wiring space. This feature, together with smart modernistic appearance, is especially important to the Machine Designer.

IT MEANS DEPEND- ABILITY

"De-ion" means *dollars-and-cents* to the plant owner, manager or superintendent. It is the PLUS factor that keeps machines in production. Machine delays due to motor starter troubles are banished, even in the face of inching operations and heavy overloads. "De-ion" Linestarters can TAKE IT when the going is hard.

IT MEANS LONG LIFE

To the Plant Engineer, "De-ion" means long life with a minimum of maintenance. On jobs calling for frequent operation, or operation at high overloads, the "De-ion" arc quencher divides and extinguishes the arc almost instantly. This high overload capacity results in practically unlimited life of arc box and contacts.

IT MEANS LESS UPKEEP

"De-ion" has a particularly important meaning for the Electrician—for it helps keep down plant operating expenses. First, it cuts installation costs because of ample wiring room, with all terminals "easy-to-get-at." For routine inspection all parts are fully accessible from the front. Long time trouble-free performance is further assured by a *balanced* sturdiness of design—both *electrical* and *mechanical*.

Only Westinghouse "De-ion" Linestarters have all the Modern Motor Starter Advantages PLUS "De-ion" Design

For complete, money-saving information, call or write your local:

WESTINGHOUSE OFFICE

ELECTRICAL WHOLESALER

MOTOR DEALER

Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

"De-ion" Linestarters

Distributed by WESTINGHOUSE

ELECTRIC SUPPLY CO.

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"SMOOTH SAILING to the PORT OF PROFITS"

Use NOFUZE TO CRACK THE TOUGHEST CUSTOMER *on your list!*

WESTINGHOUSE
ELECTRIC & MANUFACTURING COMPANY
EAST PITTSBURGH, PA.



SELLING "TOUGH PROSPECTS"

Everyone who sells, whether it be goods or services, has one or more "tough prospects" on his list.

If they were just tough, it wouldn't matter. We could hammer about them. Trouble is, those tough prospects often might be PRIZE customers. Their credit is good. Their needs run into real volume. Their business is desirable. But, boy oh boy, they do their own thinking, and they are "from Missouri!"

Has it occurred to you that the Nofuse Idea (Fuseless Circuit Protection) might be the best way to "break in" on your toughest prospects?

In the first place, it's a money-saving idea that has been well-advertised to the plants you call on. That gives you a lot to talk about -- to get them thinking about SAFETY and their electrical circuits.

And best of all -- you can back up your presentation with actual proved examples of how Nofuse Circuit Breakers have saved more than their cost the first few weeks they were in service.

Our electrical wholesalers have full details on Nofuse apparatus -- and PROOF of how they save for the plants that install them. We suggest that you call the one nearest you now, and take advantage of this way to reach the hardest-to-sell prospects.

Sincerely yours,

Westinghouse Electric Mfg. Co.

*Every House
needs
Westinghouse*

NOFUZE "DE-ION"
CIRCUIT BREAKERS
100% Safety
PLUS
Important
Savings



CS (AC) MOTORS
for any constant-speed
drive--all sizes and
types.

SK (DC) MOTORS.
Industry's most popular
general purpose
d-c. motor.

SAFETY
SWITCHES--
Every size and
type, with exclusive
Westinghouse Dia-
mond pointed jaw
construction.



"DE-ION" LINE-
STARTERS--
Most important
forward step in
entire history of
motor control.



FROM INCOMING LINE
TO DRIVEN MACHINE
Install
Westinghouse

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ELECTRIC SUPPLY CO.

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"SMOOTH SAILING to the PORT OF PROFITS"

LESS HEATING

One-Piece
Break Jaws and
Terminal Con-
nections

One-Piece
Hinge Jaws
and Fuse Clips

One-Piece
Non-Carbonizing
Composition Base

FEWER, SIMPLER PARTS

Westinghouse *Safety Switches*

DE-ION

Switches in ratings of 575 and 600 volts are equipped with the famous Westinghouse "De-ion" Arc Quencher. In the past, arcs have been broken by "stretching." The "De-ion" quencher confines, divides and extinguishes arcs instantly—obviously preventing concentration of burning heat on contacts or arc barriers.

● Maintenance is lower on Westinghouse Safety Switches because there are fewer parts to become loose, and cause harmful heating. One-piece or milled-and-ground copper parts do away with most of the customary screws and bolts. The one-piece composition base is non-carbonizing. Fuses and contacts are inspected by simply opening the cabinet.

Savings on repairs and replacements are carried still further by two additional exclusive features. The Diamond-Pointed Break Jaw and Extended Blade construction confines beading to areas which fall *outside* the contact surfaces. The "De-ion" Arc Quencher in 575 and 600-volt types confines, divides and extinguishes the arc, preventing flashover and damage to working parts.

One-piece copper parts on switches rated 200 amperes and below are readily removable from the front. On switches 400 amperes and above, copper parts are of milled-and-ground type of construction, rear-connected. Base assembly is removable from the front. All sizes and ratings, Types A, C and D. Call your local:

Electrical Wholesaler Electrical Contractor Motor Dealer

Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

J 20303



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"SMOOTH SAILING to the PORT OF PROFITS"



MUST BREAKDOWNS *Strike Unexpectedly?*

NO... *Instruments detect*
BEFORE FAILURES CAN OCCUR

UNEXPECTED shutdowns caused by the breakdown of electrical equipment are **AVOIDABLE**. The resultant loss of man and machine-hours... and, in many cases, actual spoilage of the product... is absolutely **UNNECESSARY**.

Planned, periodic testing reveals poor operating conditions on all electrical apparatus—motors, feeders, transformers—*before a breakdown can occur*. Since trouble can be anticipated, changes or repairs are made conveniently and with little loss in production time.

Every electrical device is designed to operate under definitely established voltage and current conditions. Only under these conditions will the most efficient, economical and trustworthy service be obtained.

And there is only one reliable means of determining operating conditions... the consistent use of electrical instruments.

But even the intelligent use of these instruments is not enough unless the test data has the accuracy assured by Westinghouse Portable Instruments.

J 40091

★ ★ ★

Have you received your copy of Booklet 2098, Westinghouse Portable Instruments? It has been prepared to help you select the testing instruments best suited to your needs. Ask for a copy.

ROOM 5-N, EAST PITTSBURGH, PENNA.



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ELECTRIC SUPPLY CO.

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"SMOOTH SAILING to the PORT OF PROFITS"

Quality Lamps

FOR EVERY LIGHTING NEED



BY
Westinghouse

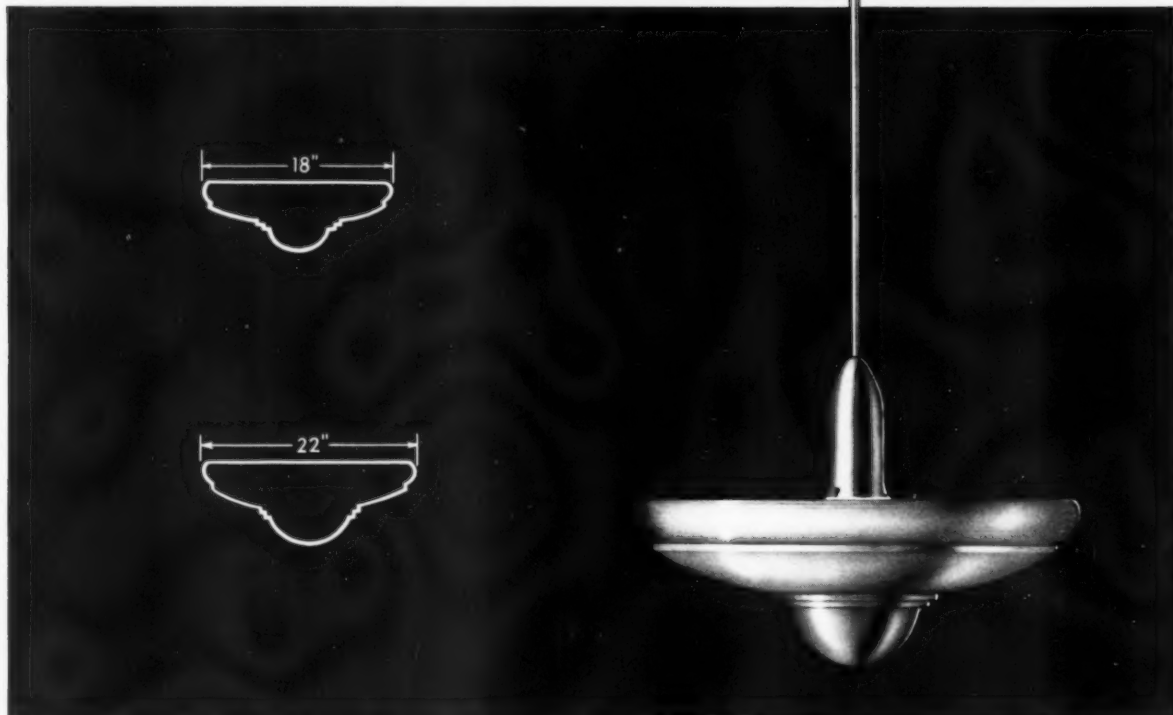
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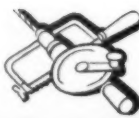
Announcing new



NEW SIMPLIFIED FEATURE FOR SHORTENING HANGER LENGTH RIGHT ON THE JOB



The socket does not screw onto the stem. It simply slips over the end of the stem and is rigidly supported by a slip pin. To shorten, you merely pull the pin and the two pieces separate.




All you need is a hack saw and a hand drill. After the two pieces are separated, you cut the hanger (no vise needed) to proper length . . . then drill a hole at the end for the slip pin.



To complete the simple operation, you merely slide the socket wire through the hanger, slip the socket assembly over the stem, and lock the two together by replacing the slip pin.

WHEN YOU THINK OF *Lighting* THINK OF

 **Westinghouse**

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"SMOOTH SAILING to the PORT OF PROFITS"

TI-500 • • TI-1000

Totally Indirect Luminaire

To meet the rapidly growing demand for a modern appearing, modern performing totally indirect commercial luminaire, Westinghouse now presents the new TI-500 and TI-1000 luminaires.

Before this new unit was designed the demands of the market were carefully analyzed. The result—a combination of styling, efficiency and maintenance features tailor-made to market needs.

DESIGN — Modern appearance of the simple streamlined contour is enhanced by beautiful brushed Alzak aluminum finish. The Alzak process finish is positive assurance that the unit will always retain its original lustre, and that light reflecting surfaces will always provide maximum efficiency.

CANOPY — The canopy is of sufficient size to cover existing outlets, and will accommodate a No. 1010 Levolver switch.

HUSK — The husk is so designed to eliminate any lamp necks showing between top of basin and husk.

SUSPENSION — The three-point suspension of the basin assures straight hanging and easy maintenance. Lamp changing and cleaning is accomplished by releasing one rod support.

STEM — A desirable feature of the stem is its special shortening feature described on facing page. This feature makes it possible to quickly shorten hangers to correct size on the job. You will appreciate this advantage.

Get complete details of this new unit at once. There's a demand for it, and an opportunity for every contractor to make big profits. See your Westinghouse Jobber for complete details. Westinghouse Electric & Manufacturing Company, Lighting Division, Edgewater Park, Cleveland, O.

Special Introductory Offer

WHEN YOU THINK OF *Lighting* THINK OF
 **Westinghouse**

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ELECTRIC SUPPLY CO.

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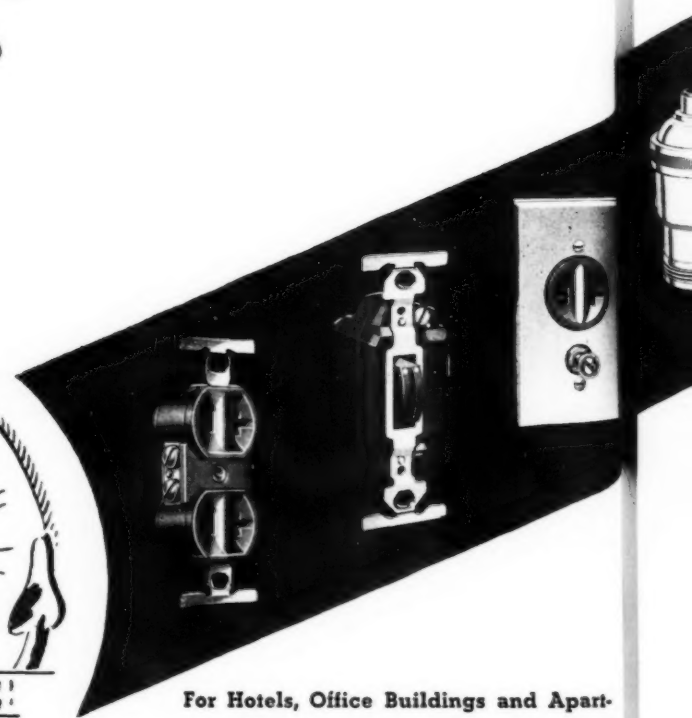
For every need . . . there is BR



For the Needs of Mansion or Small Home
... You will find in the extensive Bryant
line devices that will meet every job or
price requirement of the residential
field.



For Hotels, Office Buildings and Apart-
ment Houses . . . Bryant offers an exten-
sive line of type "C" switches for modern
lighting intensities, convenience outlets,
fan hanger outlets and other devices.



THE BRYANT ELECTRIC COMPANY

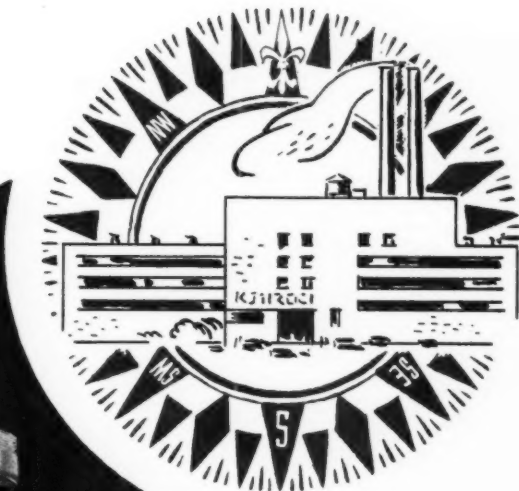
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"SMOOTH SAILING to the PORT OF PROFITS"

for every market

BRYANT Wiring Device

The Industrial Field . . . Whether the demand is for heavy duty devices, for general lighting needs, or some unusual service problem, you will find the right device in the Bryant catalog.



Sold through electrical wholesalers

The Commercial Market . . . There is a Bryant switch or receptacle for every commercial application.



Bridgeport, Connecticut NEW YORK CHICAGO SAN FRANCISCO
100 East 42nd St. 844 West Adams St. 325 Ninth St.

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"SMOOTH SAILING to the PORT OF PROFITS"

all

Cold-Rolled Open-Hearth Steel

100% Electric Resistance Weld

Adequate Protection

Light Weight

Easy to Cut

Easy to Bend and Rebend

No Threads

3 Simple Fittings

Knurled Inside Surface

Uniform Corrosion-Resistance

Easy to Install

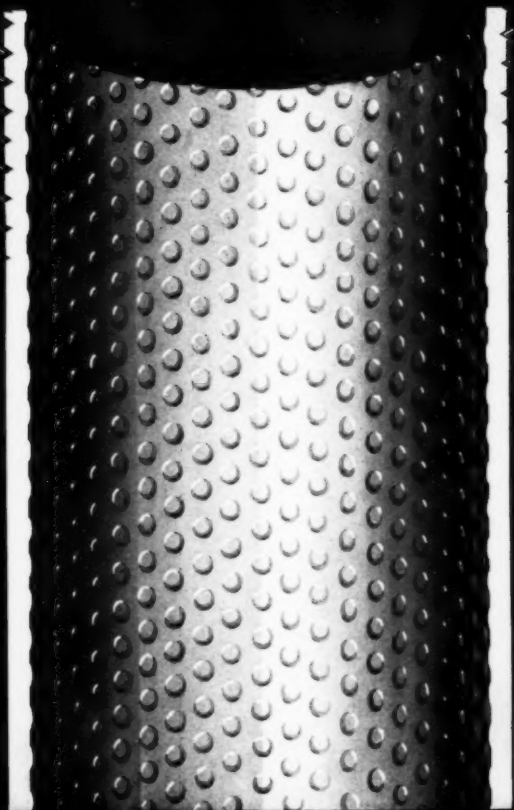
Universal Acceptance

Low Cost

Widespread Distribution

Assistance of a Field Force

Adequate Protection



Steeeltubes

MORE THAN 150,000,000 FEET INSTALLED

Distributed by **WESTINGHOUSE**

ELECTRIC SUPPLY CO.

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"SMOOTH SAILING to the PORT OF PROFITS"

Protection

WITH THIS BETTER RACEWAY FOR WIRING

● Look at the illustration at the left. There you see the contrast between the walls of ELECTRUNIT Steeltubes and ordinary threaded conduit. ● The wall thickness of ELECTRUNIT Steeltubes was not arrived at by guesswork but is the thickness recommended by the Underwriter's Laboratories for adequate electrical and mechanical protection. Notice that at joints, where ordinary conduit is cut away in threading, ELECTRUNIT Steeltubes has a greater wall thickness, providing greater protection. Notice, too, that at unthreaded portions, the wall of ordinary conduit is thicker than necessary — therefore, heavier and more difficult to handle. Both have the same inside diameter for wires. ● Because it is made by a modern process — because it is threadless, lighter in weight and easier to handle, bend and install — *genuine* ELECTRUNIT Steeltubes provides a means for you to offer the positive protection of a "pull-in—pull-out" system at lower cost per outlet—and at higher profit to you. Other contractors are using it to obtain a greater share of the business in their territories. Why don't you?



Ask your electrical wholesaler to give you figures showing that *genuine* ELECTRUNIT Steeltubes, with all fittings, costs less to buy and to install than ordinary conduit—and no more than imitation brands that do not offer all of its advantages. If he doesn't stock it, write us for complete detailed information and the name of your nearest distributor.

Knurled inside finish (patent No. 1,962,876) available in 1/2", 3/4" and 1" sizes.



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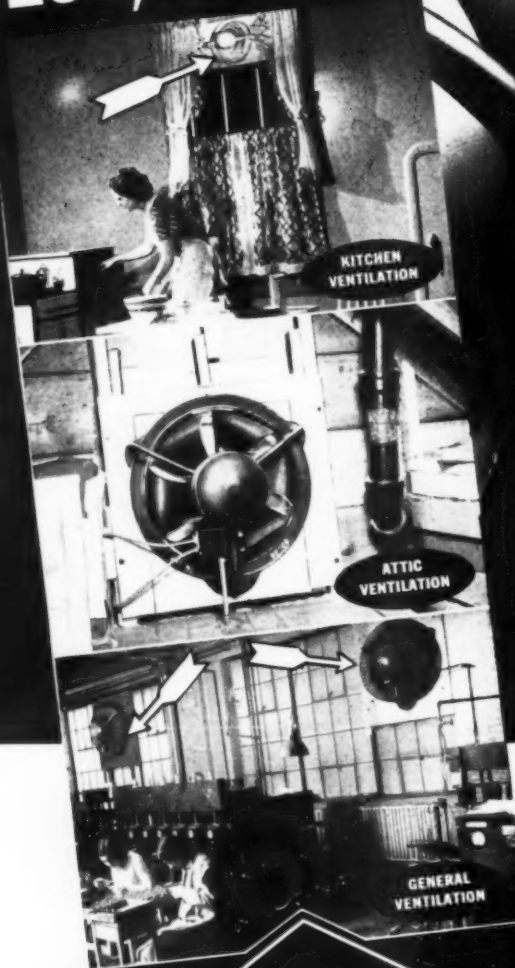
ELECTRIC SUPPLY CO.

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"SMOOTH SAILING to the PORT OF PROFITS"



RECOMMENDED
To You by More Than
250,000 USERS



ILG
VENTILATING FANS

**FULLY ENCLOSED
SELF-COOLED
MOTOR**

**CERTIFIED
RATINGS**

**MORE AIR
LESS POWER**

**GUARANTEED
AS A
COMPLETE UNIT**



ILG ELECTRIC VENTILATING CO.
2879 N. CRAWFORD AVE., CHICAGO, ILL.

Distributed by **WESTINGHOUSE**

ELECTRIC SUPPLY CO.

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"SMOOTH SAILING to the PORT OF PROFITS"

SELF-COOLED MOTOR FAN



KITCHEN VENTILATION — Send for booklet illustrating and describing the complete line of ILG Kitchen Ventilators for 1937. See the new Ligette models, especially designed and priced for small kitchens.

ATTIC VENTILATION — Ask for pictorial bulletins featuring the Ligattie System of cooling and ventilating homes, stores, public buildings, etc. Learn all about the new Ilgwind Fan.

GENERAL VENTILATION — Almost everything you want to know about ventilation in general is graphically explained and illustrated in the new ILG Catalog — free upon request.

You'll have no worries about interrupted service and costly repairs due to leaky shaft seals, when you install Westinghouse Water Coolers, because refrigerant, oil, and entire mechanism are hermetically sealed within walls of steel. And Westinghouse backs this pledge of satisfactory performance with the 5-year protection plan against service expense on this sealed-in mechanism.

In addition, you gain other plus values from Westinghouse Hermetically-sealed Water Coolers, such as:

- Air-cooled or water-cooled mechanism.
- Brushless motors that won't burn out.
- Improved Dual-action evaporators.
- Non-clogging drains . . . sanitary bubblers.
- Freon refrigerant . . . temperature selector.

For details on how Westinghouse Water Coolers will save you money, see your local dealer, or write Dept. 7362, Westinghouse Electric & Manufacturing Company, Mansfield, Ohio.

REMEMBER...WESTINGHOUSE GIVES YOU
BOTH HERMETICALLY-SEALED UNITS
AND THE 5-YEAR PROTECTION PLAN

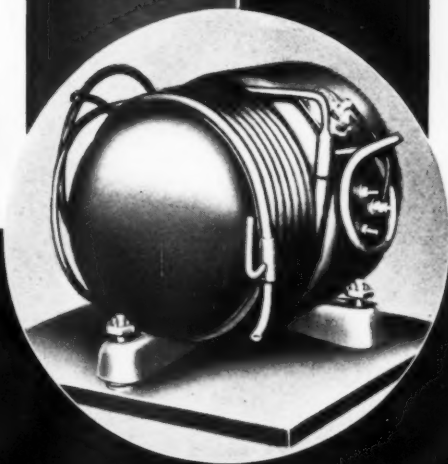


Westinghouse

Hermetically-Sealed

WATER COOLERS

Freeze-proof and explosion-proof models for special applications.



Distributed by **WESTINGHOUSE**



ELECTRIC SUPPLY CO.

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"SMOOTH SAILING to the PORT OF PROFITS"

It's **TOUGH!**



YOU PRACTICALLY CAN'T BREAK IT! Heave it on a concrete floor and its beam won't even flicker.

IT WON'T DENT, SCRATCH OR SHOW SIGNS OF WEAR.

ACIDS, ALKALIES WON'T AFFECT ITS FINISH.

IT'S COMPLETELY INSULATED. No metal on outside of case—can be safely used around “hot” wires.

THE “EVEREADY” INDUSTRIAL FLASHLIGHT

TWO SIZES:

The 2-Cell

The 3-Cell



THE “EVEREADY” “IGNITOR”


For years the outstanding all-purpose dry cell. Long a universal favorite, it stands the test, year after year, in all kinds of jobs.

The words “Eveready” and “Ignitor” are Trade Marks of the National Carbon Co.

NATIONAL CARBON COMPANY, INC.

GENERAL OFFICES: New York, N. Y.

BRANCHES: Chicago • San Francisco

Unit of Union Carbide  and Carbon Corporation

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“SMOOTH SAILING to the PORT OF PROFITS”



Get the More Profitable Jobs

WITH "ATTRACTION-ZONE" LIGHTING

Every merchant in your territory wants to do more business . . . Step up and show him how "Attraction-Zone" Lighting increases sales anywhere from 25 to 75%, and your own sales will climb, too. You'll find that "Attraction-Zone" sales lead to interior store lighting jobs . . . thereby increasing your volume with just a *little* additional effort on your part.

Many thousands of dollars are being spent to make merchants "modernization minded". Get behind this move and you'll be in front on profits.



Curtis X-Ray Reflectors are recognized the world over as the outstanding window lighting reflectors. Concentrate your efforts on the Curtis line . . . it's easier to sell.



PREFERRED BY EXPERIENCED CONTRACTORS

★ JEFFERSON FUSES • BOXES



Above: Perrot
Type Jefferson-
Union Renew-
able Fuse.

At left: Two sizes
of knife-blade
type Jefferson-
Union Renewable
Fuses.

Below: Gem X Switch
Box, showing 7-8
Clamps and Pri-Outs.

Gem B Switch Box
for rigid conduit.

No. 1285-X
Octagon
Outlet Box.

Below: Universal
Drawn Box No. 160.

No. 103
Octagon
Outlet Box.

No. 1285XB Set-Up Outlet Box with
Bar Hanger and Fixture Stub.

At right: 4" Square
Outlet Box No. 102.

At left: 4" Octagonal Box
with 1/2" and 3/4" Knockouts
for concrete installation.

● When the present heads of contracting and engineering firms were getting their early experience in electrical wiring and construction—Gem Sectional Switch Boxes—Outlet Boxes, and Jefferson-Union Fuses had already proven their uniform quality and dependability.

Being practical men—these contractors and engineers have recognized that fuses must be simple and rugged—and the renewable fuses easy to renew.

Uniformly made outlet and switch boxes save time in installation—eliminate further servicing. Jefferson Gem and Union Boxes have been regularly specified by leading firms for more than a quarter of a century.

Because electrical contractors have had so much to do with widening the successful use of electricity—Jefferson Electric is more anxious than ever to provide trouble-free products.

Distributed by **WESTINGHOUSE**  **ELECTRIC SUPPLY CO.** BRANCHES ON LAST INSERT PAGE
"SMOOTH SAILING to the PORT OF PROFITS"

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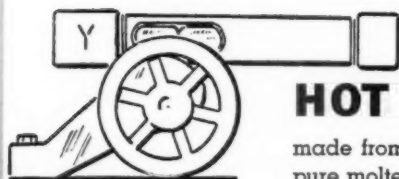
BIG Let these **PROFIT** **GUNS**

Shoot Down Your Costs

If you have considered that conduit is just a price proposition, there's a pleasant surprise waiting for you in Buckeye Conduit.

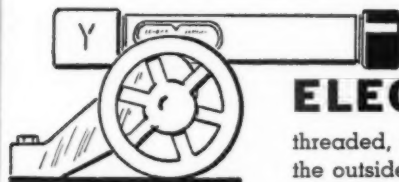
Find out for yourself how the correct combination of ductility and strength will let you set a bend quickly yet never throw a flat in the radius. Find out the speed that comes with clean chased and well protected threads. Find out how that smooth oven baked lacquer lining will let you push through many places where you should be snaking.

Ask for Buckeye by name, and get set for more speed and a better profit.



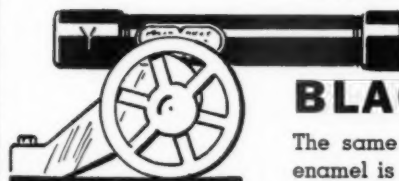
HOT GALVANIZED

made from selected pipe thoroughly pickled and cleaned. Galvanized in pure molten zinc, and specially processed for smoothness of coating, inside and out. Finally a tough coating of transparent enamel is baked on both inside and outside.



ELECTRO-GALVANIZED

threaded, reamed, inspected and cleaned, this conduit is galvanized on the outside only. The interior is coated with a tough elastic black enamel, baked on of course, but exceptionally flexible. Finally, transparent enamel is applied both inside and out.



BLACK ENAMELED

The same careful selection of pipe steel precedes this fabrication. The enamel is applied by dipping and is air set before baking. Oven control is accurately maintained by pyrometers to insure a high lustre tight coat that will be both tough and elastic.

THE YOUNGSTOWN SHEET AND TUBE COMPANY
Manufacturers of Carbon and Alloy Steels • General Offices: Youngstown, Ohio
CONDUIT • PIPE AND TUBULAR PRODUCTS • SHEETS • PLATES • TIN PLATE
BARS • RODS • WIRE • NAILS • UNIONS • TIE PLATES AND SPIKES

26-3



YOUNGSTOWN

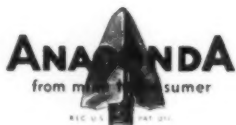
If you're looking for a tough portable cable...

DURACORD

Each of these 5 features means extra service!

- **DURACORD**—is really weather-proof! Weather and exposure have little or no effect.
- Is strong! Cover embedded in rubber belt gives Duracord high tensile strength.
- Has non-fray cover! Woven like a firehose, Duracord wears and wears.
- Is oil-resisting! Place it in oil and discover its oil-resisting qualities.
- Is flexible! As twisty as a snake despite its amazing toughness.

Use Duracord any place and every place where a better portable cable is needed. Made in sizes No. 18 to 500,000 C.M. inclusive. 1 to 4 conductors.



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ELECTRIC SUPPLY CO.

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"SMOOTH SAILING to the PORT OF PROFITS"

For Corrosive Conditions



*EVERDUR is a trade-mark of The American Brass Company registered in the United States Patent Office.

Everdur

ELECTRICAL CONDUIT

- 1 Where various chemicals are prevalent in surrounding air, soil or construction materials.
- 2 In atmospheres containing fumes, bone dust, etc.
- 3 In humid atmospheres, and areas where unusual atmospheric condensation takes place.
- 4 In coastal areas, or wherever salt atmospheres are encountered.
- 5 In atmospheres containing smoke, soot or industrial gas.
- 6 In hazardous locations where atmospheres are charged with metal dust, carbon black, coal, coke or grain dust.
- 7 Wherever ethyl ether, gasoline, common petroleum, ethyl alcohol, methyl alcohol, acetone or lacquer solvent vapors are encountered.
- 8 Wherever permanence and freedom from repairs and replacement is desired.

Everdur* Silicon Bronze was developed by The American Brass Company to meet a long-felt need for a non-corrosive metal — strong as steel yet rustless as copper!

Everdur Electrical Conduit is strong, durable, and highly resistant to a wide range of corroding agents. Of uniform temper and size, it can be cut,

threaded, bent and assembled with the same equipment used for steel conduit or tubing. Manufactured in standard sizes and in two wall thicknesses, electrical metallic tubing (E. M. T.) and rigid conduit (R.C.). Listed and labeled by Underwriters' Laboratories. Several complete lines of threaded and threadless Everdur Fittings are available.

THE AMERICAN BRASS COMPANY



General Offices: Waterbury, Connecticut
Offices and Agencies in Principal Cities

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ELECTRIC SUPPLY CO.

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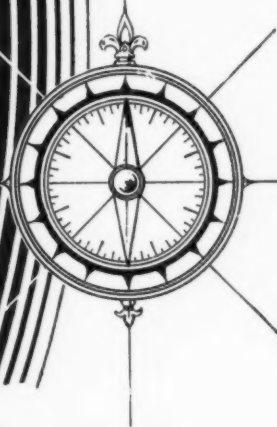


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ELECTRIC SUPPLY CO.

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"SMOOTH SAILING to the PORT OF PROFITS"



CABLE



GUARDIAN should be your first and all-time choice in Building Wire for its ease of installation, free-stripping insulation, and enduring service to your customer.

ROMEX — the Original is still your prime choice, where specifications or your own good salesmanship make a Non-Metallic Sheathed Cable job.

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"SMOOTH SAILING to the PORT OF PROFITS"



WHY THIS NEW COUPLING CAN'T SPLIT

Driving forces tapered conduit ends solidly against fillet in center of coupling. Pressure is held on direct line through fillet. Ends cannot wedge and press outward to split the coupling.

SPEEDY completion of the job pays off in reduced labor costs and greater profits. That's why profit-alert contractors choose Bermico Dura-Cell for their conduit jobs.

A non-split coupling speeds the installation of Bermico Dura-Cell. Able to withstand heavy driving, it gives a tight joint . . . prevents grout seeping into duct . . . cuts rodding costs . . . ends expense and loss of time involved in replacing broken couplings.

Light in weight, Bermico Dura-Cell is easily handled. Tough, virgin wood fibre gives it exceptional strength—Bermico Dura-Cell passes all underwriters' tests with wide margins of safety.

Use Bermico Dura-Cell to speed up your next job—and increase your profits.

A PRODUCT OF BROWN COMPANY, PORTLAND, MAINE

BERMICO DURA-CELL CONDUIT

Distributed by **WESTINGHOUSE**

ELECTRIC SUPPLY CO.

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"SMOOTH SAILING to the PORT OF PROFITS"

PERFORMITE

The Modern RUBBER INSULATION



*It's Superaging
It's Heat Resisting
It's Moisture Resisting*

BY ALL known accelerated aging tests **PERFORMITE** rubber insulation is far ahead of any other commercial insulation. It is non-corrosive, free-stripping, long-lasting.

Only **PERFORMITE** can show such little deterioration after 504 hours in the Oxygen Bomb, as well as the Air Bomb test at 260° Fahr. and the Air Oven at 250° Fahr.

It stands more heat than ordinary insulations—may be operated at 75° C. copper temperature.

As illustrating **PERFORMITE'S** moisture-resistance, samples immersed in water for 14 days show: Between the first and 14th day, not over 20% increase in electrical constant; between 7th and 14th day, not over 5%.

PERFORMITE should be specified for monumental building jobs, for airport, park and street lighting; and for all vital circuits where failure would be expensive, or wherever safety and long life are essential.

Meets requirements of Federal Specs. JC106, JC121 and Dept. Commerce Airport Specs.



HAZARD INSULATED WIRE WORKS

Division of the Okonite Company
WORKS: WILKES-BARRE, PA.

Sales

Offices:

New York Chicago Philadelphia
Atlanta Seattle Dallas Washington



Pittsburgh Buffalo Boston Detroit
San Francisco St. Louis Los Angeles

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ELECTRIC SUPPLY CO.

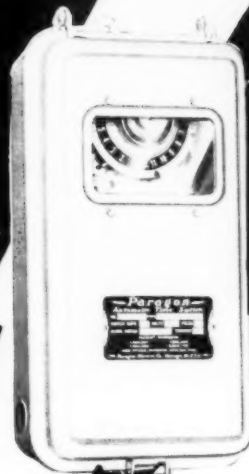
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"SMOOTH SAILING to the PORT OF PROFITS"

Indoor
Model



Outdoor
Model



SET THE STANDARD IN THE CONTROLS

The simplicity of design and the sturdy construction of Paragon Time Switches insure absolute accuracy of operation, widest range of application and greatest economy of installation.

Paragon Time Switches are longest lived because they contain no fragile or complicated mechanism. Their dependability is unaffected by location — indoors or outdoors — in dusty or damp basements — in hot dry atmosphere or in sleet and snow. The weather-tight enclosure — dust-tight and water-tight — protect them, completely.

Paragon Time Switches eliminate unnecessary service expense, because they are built to exacting industrial standards — not to cheap clock principles — by one of America's oldest and largest exclusive time control manufacturers.

AND — Paragon Time Switches are priced at lowest initial cost for known and guaranteed dependability of performance.


*For detailed information
write for Bulletin 3743*

PARAGON TIME SWITCHES

For
Store Window,
Apartment House,
Sign and Billboard
Lighting,
Alarm Systems,
Traffic Systems,
Street Lighting,
Flood Lighting,
Poultry House
Lighting

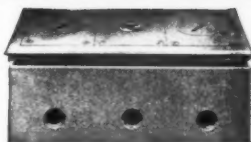
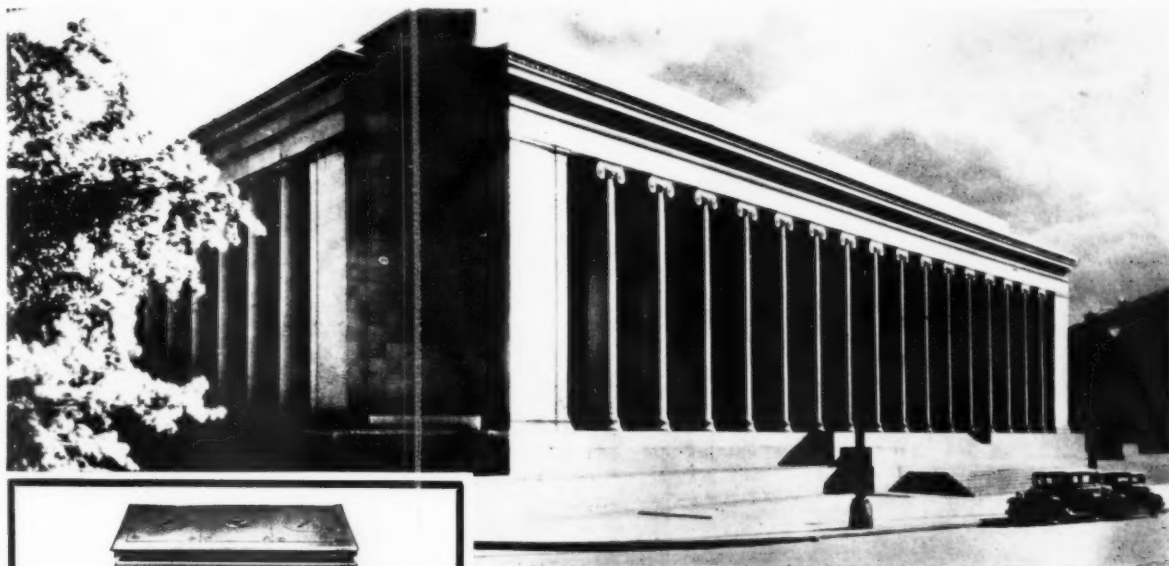
PARAGON INDUSTRIAL TIMERS

For
Air Conditioning,
Stokers,
Oil Burners,
Gas Furnaces,
Pumps,
Refrigeration,
Process Timing,
Program Timing,
Bell Ringing,
Water Heating

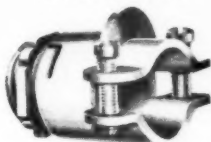
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"SMOOTH SAILING to the PORT OF PROFITS"



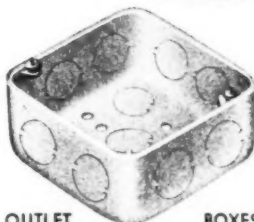
FLOOR OUTLETS



CONNECTORS

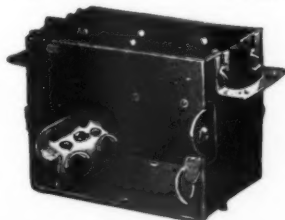


ENTRANCE
FITTINGS



OUTLET

BOXES



SWITCH BOXES

STEEL CITY PRODUCTS

used in the MELLON INSTITUTE

In the new Mellon Institute, world's finest structure devoted to industrial research, exacting electrical demands made the choice of quality equipment of vital importance.

Steel City is proud of the part that its products play in the smooth, efficient operation of this intricate electrical installation.

Steel City quality is equally important on every job where pride in workmanship and trouble-free operation are factors.

We Manufacture:

—A complete line of outlet boxes, covers, switch boxes, floor boxes and conduit fittings. Also several specialty items bearing nationally known trade names.

SEND FOR OUR NEW CATALOG!

STEEL CITY ELECTRIC COMPANY

PITTSBURGH, PENN.

Distributed by **WESTINGHOUSE**

ELECTRIC SUPPLY CO.

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"SMOOTH SAILING to the PORT OF PROFITS"

Wherever you are, there's a completely stocked branch within

ALBANY, N. Y., 454 N. Pearl St.
 ALLENTOWN, PA., 522 Maple St.
 ATLANTA, GA., 96 Poplar St., N.W.
 AUGUSTA, ME., 90 Water St.
 BALTIMORE, MD., 40 S. Calvert St.
 BANGOR, ME., 175 Broad St.
 BINGHAMTON, N. Y., 87 Chenango St.
 BOSTON, MASS., 76 Pearl St.
 BURLINGTON, VT., 208 Flynn Ave.
 BUTTE, MONTANA, 50 E. Broadway
 CHARLOTTE, N. C., 210 E. Sixth St.
 CHICAGO, ILL., 113 North May St.
 CLEVELAND, OHIO, 3950 Prospect Ave.
 COLUMBIA, S. C., 915 Lady St.
 DALLAS, TEXAS, 409 Browder St.
 DES MOINES, IOWA, 218 Second St.
 DETROIT, MICH., 547 Harper Ave.
 DULUTH, MINN., 308 W. Michigan St.
 EVANSVILLE, IND., 201 N. W. First St.
 FLINT, MICH., 1314 N. Saginaw St.
 FORT WORTH, TEXAS, 501 Jones St.
 GRAND RAPIDS, MICH., 507 Monroe Ave., N. W.
 GREENVILLE, S. C., 200 River St.
 HOUSTON, TEXAS, 1903 Ruiz St.
 INDIANAPOLIS, IND., 137 So. Pennsylvania St.
 JACKSONVILLE, FLA., 37 South Hogan St.

LOS ANGELES, CALIF., 905 E. Second St.
 MADISON, WISC., 1022 E. Washington Ave.
 MIAMI, FLA., 1036 N. Miami Ave.
 MEMPHIS, TENN., 366 Madison Ave.
 MILWAUKEE, WISC., 546 N. Broadway
 MINNEAPOLIS, MINN., 215 South Fourth St.
 NEWARK, N. J., 49 Liberty St.
 NEW HAVEN, CONN., 240 Cedar St.
 NEW YORK, N. Y., 150 Varick St.
 NORFOLK, VA., 254 Tazewell St.



**WHAT YOU NEED
 WHEN YOU NEED IT
 WHERE YOU NEED IT
 FROM ONE
 SOURCE OF SUPPLY**

OAKLAND, CALIF., Tenth & Alice Sts.
 OKLAHOMA CITY, OKLA., 10 E. California St.
 OMAHA, NEB., 117 N. Thirteenth St.
 PEORIA, ILL., 104 East State St.
 PHILADELPHIA, PA., 1101 Race St.
 PHOENIX, ARIZONA, 315 West Jackson St.
 PORTLAND, OREGON, 134 N. W. Eighth Ave.
 PROVIDENCE, R. I., 66 Ship St.
 RALEIGH, N. C., 322 S. Harrington St.
 READING, PA., 619 Spruce St.
 RICHMOND, VA., 301 S. Fifth St.
 ROANOKE, VA., 726 First St., S. E.
 ROCHESTER, N. Y., 240 St. Paul St.
 ST. LOUIS, MO., 1011 Spruce St.
 ST. PAUL, MINN., 145 E. Fifth St.
 SACRAMENTO, CAL., 20th & R Sts.
 SALT LAKE CITY, UTAH, 235 West South Temple St.
 SAN ANTONIO, TEXAS, 1201 East Houston St.
 SAN FRANCISCO, CALIF., 260 Fifth St.
 SEATTLE, WASH., 588 First Ave., South
 SIOUX CITY, IOWA, 1005 Dace St.
 SPOKANE, WASH., 152 So. Monroe St.
 SPRINGFIELD, MASS., 46 Hampden St.

SYRACUSE, N. Y., 961 W. Genesee St.
 TAMPA, FLA., 416 Ellamae St.
 TOLEDO, OHIO, 812 Lafayette St.
 TRENTON, N. J., 245 N. Broad St.
 TULSA, OKLA., 303 East Brady St.
 UTICA, N. Y., 113 N. Genesee St.
 WASHINGTON, D. C., 1216 K St., N. W.
 WATERLOO, IOWA, 328 Jefferson St.
 WICHITA, KANSAS, 233 South St. Francis Ave.
 WILMINGTON, DEL., 216 E. Second St.
 WORCESTER, MASS., 24 Southbridge St.
 YORK, PA., 143 S. George St.



Westinghouse
Electric Supply Company

A National Distributing Organization

For Better LIGHTING JOBS

SERVICE STATION LIGHTING

Floodlighting of a service station should allow passing motorists to see the station, and yet the floods should not interfere with any adjoining private



LOW LIGHTS—Standard Oil station, Cleveland, Ohio, with island units mounted lower. This Abolite island reflector has a glass eye in the monitor top, which throws light on the front of the station. They use 500 watt bulbs.



HIGH LIGHTS—Pure Oil station, Coshocton, Ohio, with Abolite island reflectors, mounted high above the pumps. They burn 500 watt lamps in both the island lights and the floodlights.

property. Therefore, the major portion of the lighting work falls to the island reflectors.

Service racks must have good light supplied by a mobile type unit, permitting the operator to "spot" his light according to the part of the automobile on which he is working. For all types of service station work the open type porcelain enamel reflector harmonizes well with the modern porcelain stations—and supplies plenty of light.

A SHADOW-SCREEN HAS MANY USES

For garden and stage settings, auditorium and lobby displays and decorations in department stores, dance halls, night clubs and roof gardens, the shadow screen has interesting possibilities. It can be used to create many small lighting jobs.

Any translucent material will do for the screen, but one which obscures the light sources while still letting a considerable proportion of light pass, is best. In the illustration, a bleached, closely woven muslin was used. Tracing paper is suitable; or flashed opal or sand-blasted glass. If the light sources

are immediately behind the screen and likely to be seen, a more diffusing material is necessary.

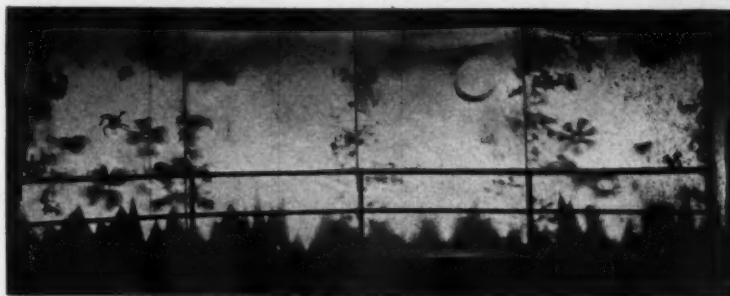
For outdoor installations, lacquering the muslin with transparent lacquer adds to the diffusive properties, and the screen will weather better. If this is not done the muslin will shrink when wet, unless it is wet before installing on the frame and allowed to dry.

For a large screen use 54-inch material to reduce the number of seams. The strips of material may be pinned together, or sewed.

Spacing is dependent upon the size of objects, of screen, and the available space. The closer an object is placed to the screen the sharper and blacker the silhouette: the further the lights are from the screen the sharper and smaller the shadows.

With a projection distance of about five feet, objects are placed against the screen and from there to about 10 inches back of it.

Use concentrating reflectors, spotlights, or bare lamps depending upon the effect desired. With reflectors and spotlights more light is put on the object with less loss. In the installation shown, a combination of G. E. Handy Floods and exposed colored lamps were

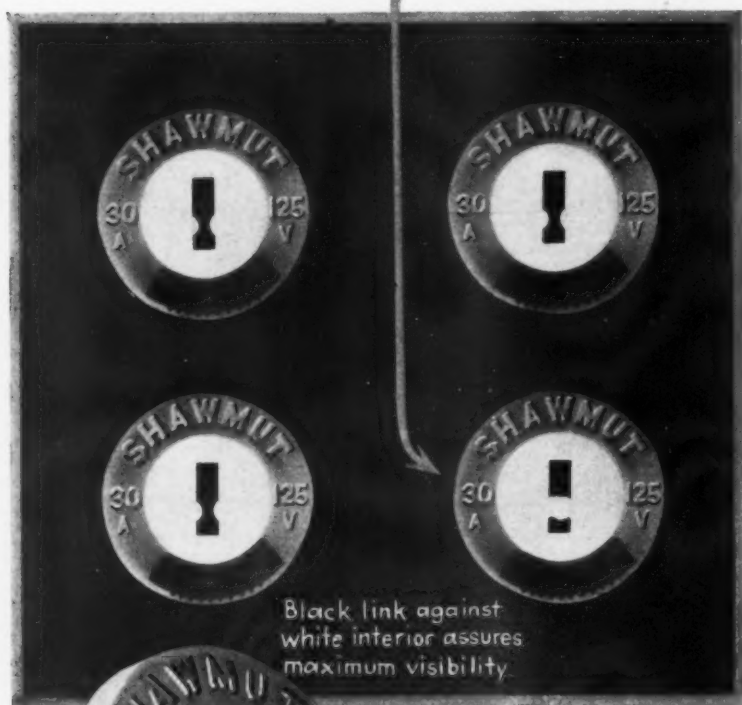


SHADOW MAGIC—This garden party installation suggests the possibilities of shadow light, for temporary or permanent unit.

Which one blew?

—the answer in 2 SECONDS!

—when blown on light overloads



Black link against
white interior assures
maximum visibility



Shawmut BLAC-LINK

Labeled
PLUG FUSES

For circuit protection under all conditions a fuse has no substitute, because when a fuse blows, the circuit is opened; and a fuse is not dependent on mechanical operation.

THE CHASE-SHAWMUT CO.

NEWBURYPORT, MASS.

FUSE SPECIALISTS SINCE 1893

For Better
LIGHTING JOBS

[FROM PAGE 87]

used. Twinkling flashers and other flashing effects can be added.

A wide variety of color effects is possible. The right choice is largely a matter of experiment but there are certain principles which seem to apply.

Color groups are best rather than hit or miss colors, so that a definite color will come from a certain direction. For instance, in a 6-inch panel several blue reflectors might be grouped at the bottom and at one side and several green at the other side. This will provide a general color tone for the background and bold color shadows. The addition of scattered red or blue amber lamps will add the highlights. In like manner, red and blue might be used for the ground coat with amber for the highlights. The use of clear lamps might also work out to advantage.

Many simple materials may be used for projecting the shadows. In the picture, leaves formed the borders of the panels, the bottom edge was made up of a jagged piece of beaver board, and barrel hoops were suspended in the center panels. At the sides were flowers cut out of beaver board.




LIGHT DRAUGHTING—In this draughting room of the Republic Flow Meter Co. in Chicago, 150-watt lamps on 30-in. centers are installed in Curtis "Light-Hood" equipment. The men have 35-foot candles on the board, well diffused and easy on the eyes.

LUMAR MARBLE

Translucent marble of various types is now available. It is known as Lumar and is sold by the Vermont Marble Company.

By placing lamps in a white finished cavity behind the marble the face becomes luminous. Designs can then be sand-blasted upon the marble to pro-

Electrical Contracting, July 1937



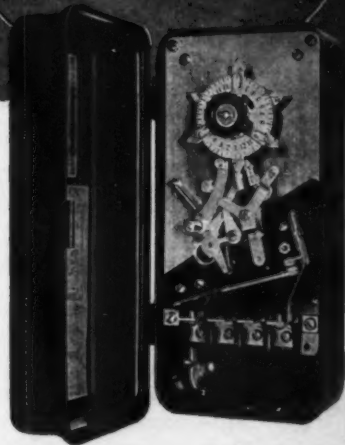
THE UNSEEN HAND

that makes

AIR CONDITIONING COMPLETELY AUTOMATIC

NOW is the time when aggressive electrical contractors can cash in on new profits through selling Sangamo Time-Switches for office air conditioning units.

But... you must *first* call attention to the attractive savings effected, when *the unseen hand* automatically discontinues operation of the unit for the night, and resumes its function at the proper time before office hours. It will pay you handsomely to investigate this new opportunity.



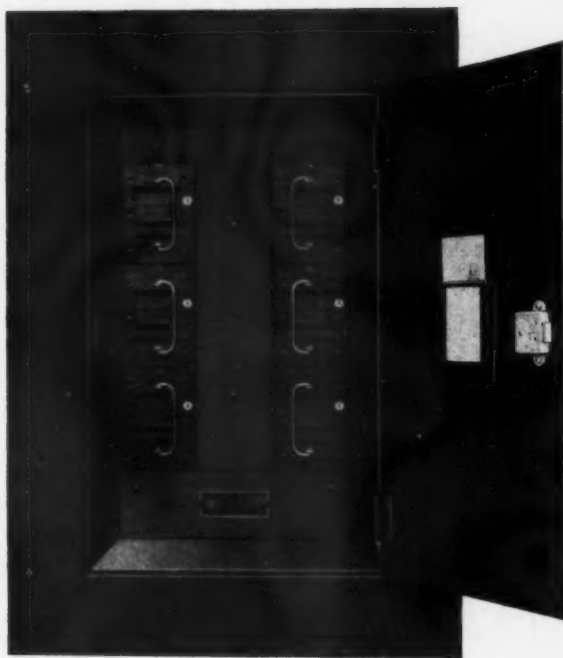
Sangamo Form K Time-Switch will control A.C. office air conditioning units for daytime operation only. Other Sangamo Time-Switches are available for any required schedule of operation.

SANGAMO ELECTRIC COMPANY **SPRINGFIELD ILLINOIS**



Panelboards

"THE SIGN OF A BETTER JOB"



® Pulfuzswitch Safety Type Feeder Panelboard

You Get **DELIVERIES** on **TIME** WHEN YOU ORDER

Because ® has always considered *prompt delivery* one of its most important functions in servicing contractors, you are sure of getting material on the job when it is promised. . . . This avoids construction delays — penalty losses — creates satisfied customers — builds and maintains good will.

In addition, ® Service to Contractors includes:

1. A dependable quotation, in time to use in the contractor's bid . . . 2. Standardized unit construction that always assures an accurate fit of all component parts . . . 3. Standard panelboards to meet any standard requirements . . . 4. Special design panelboards to meet any special requirements . . . 5. Satisfying your customers in every respect . . . 6. Identifying yourself as a quality contractor with the visible ® quality trade mark.

Get New Catalog No. 56

Frank Adam

ELECTRIC COMPANY

ST. LOUIS

For Better LIGHTING JOBS

[FROM PAGE 90]

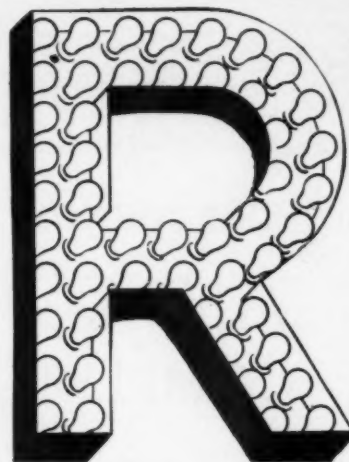


FOR DECORATION—Marble lighted from behind offers many possibilities in stores and public buildings.

duce intaglio patterns or letters which may also vary in brightness. Depending upon the nature of the room, a panel requires from 25 to 50 watts of lighting per square foot of marble.

TWINKLE LETTERS

Brightness and sparkle can be provided by a well arranged system of exposed lamps in a channel form with

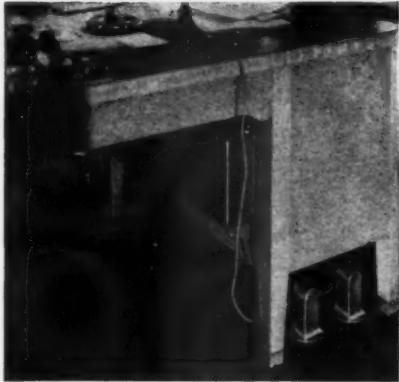


FLASH TRICK — Trough letter, crowded with lamps, gives sparkle effect.

a good white background. The lamps should be on four-inch centers and wired on four circuits for flashing. Instead of the running one-two-three-four motion used in border effects, they should be flashed rapidly in one-three-two-four sequence to give a twinkling sparkle.

Electrical Contracting, July 1937

A Vital Contribution TO MODERN WIRING PRACTICE



TWO FLOOR OUTLETS under a desk in office area of Kaeshin Terminal Building. One outlet is for 110V, and the other for telephone. Wiring is carried directly through floor cells, not only for service outlets on this floor area, but for lighting fixtures on ceiling below.

A TELEPHONE SERVICE MAN installing a new outlet to be placed under a desk on the Robertson Floor. New outlets may be cut in at any location desired, whenever necessary, when the Robertson Wiring Method is used.



CLOSE-UP of painted underside of Robertson Floor units forming the ceiling of this second floor in the Kaeshin Freight Lines Terminal Building in Chicago. The two underside headers at right gather up the 110V. and telephone wiring, which is led directly through the cells of the floor. Bottom covers of these headers can be easily removed to enter headers at will.

THE Robertson Steel Floor provides a new and better method of wiring distribution... a method of tremendous value, in that it makes possible a more flexible and comprehensive layout. Every hollow steel cell of the Robertson Floor may serve as a *protected wireway*... of exceptionally generous capacity... for the distribution of wiring.

This means you can give your customers a better job... a job that will be adequate

and satisfactory for a longer time. A job that will insure the building owner against premature electrical obsolescence by providing him with electrical advantages calculated to take care of future needs safely, conveniently and economically.

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ings in which the Robertson Floor is used. The book contains complete information... describes in detail how to take full advantage of the floor's electrical possibilities. It gives you layout data, engineering facts, installation information. H. H. Robertson Company, Grant Building, Pittsburgh, Pa.

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City State

Questions ON THE CODE

Answered by F. N. M. SQUIRES

Chief Inspector New York Board of Fire Underwriters

Grounding of Switch Boxes

Q. "In the May issue of *Electrical Contracting* you answer a question on the grounding of motors. Your answer states that rules 1006c, 905a5 and 1202d require that controller cases and switch and circuit breaker enclosures be grounded, unless they are accessible only to qualified persons. The question had stated that the circuit was a three-wire a.c. 110-220 volt circuit with voltage to ground less than 150. As I read the paragraphs of the 1935 edition to which you refer, grounding is not required if the voltage is less than 150 to ground. How about it?"—A.B.S.

A. The 1935 Code, rules 1006c and 905a4, require that all controller cases be grounded, regardless of the voltage to ground of the wires connected to the controllers. Our correspondent is correct, however, in that Code rule 905a5 and 1202d require the grounding of switch and circuit breaker enclosures, only when the wires connected to these devices are above 150 volts to ground, or unless the enclosures are part of a metallic wiring system. On the strength of the first paragraph above, we still maintain that if the switch or circuit breakers were used as motor controllers, then the rule dealing with controller cases would apply and these cases should then be grounded.

Potheads or Porcelain Box-Covers?

Q. "I have just run into a job on a 2300 volt generator, where the leads to the switchboard leave the conduit through the porcelain covers of a conduit. Is this in compliance with the Code or should potheads be used?"—M.B.

A. According to rule 5002d, where it emerges from its metal sheath, cable, lead or otherwise, shall have its insulation, for the several conductors,

protected by a pothead or equivalent means. In case conduit is used, the porcelain cover of a conduit fitting would be sufficient.

Cable for Service Entrance

Q. I was informed recently that service cable could now be used from meter enclosure to switch cabinet instead of conduit. Is this permissible? This should save considerable time and labor in putting up conduit and attending equipment.—J.P.H.

A. Service entrance cable may be used for service entrance work from the wires of the supply system to the service equipment, provided that the proper type of cable is used in each



BRIDGEPORT AHOY—June first marked the beginning of regular city electrical inspection service in Bridgeport, Conn., this work having been previously handled by a local fire prevention official. Harry C. Abercrombie, former electrical contractor and association worker, was drafted for the new post of city inspector. So Harry resigned as president of the Bridgeport Master Electrical Contractors Association, a post held for four years. He also gave up a ten-year presidency of the Connecticut Electrical Contractors Association. What a man!

portion of the service run. For instance, service drop (type S.D.) cable could not be used unprotected down the side of a house, where type A.S.E. would be required. If the so-called "bare neutral" type is used, it cannot be employed beyond the service equipment, except for range circuits only.

Sealing in Explosion-proof Work

"As a subscriber to *Electrical Contracting* I request your advice concerning the correct interpretation and application of the N.E.C. rules for sealing conduits in Class 1 Hazardous Locations. Section 3203, Paragraph C, states that conduit shall be sealed off (1) where terminating in an enclosure in which arcing or sparking is likely to occur. (2) where conduit leads from a hazardous to a non-hazardous location. I would like to ask four questions."—W.J.F.

Q. 1. "Is not arcing or sparking likely to occur in a junction box Type G U A, particularly when circuits are being traced, or during re-wiring, when it is impossible to shut down gasoline pumps in a service station? Therefore, should not the conduits terminating in junction boxes in gasoline pumps be sealed off? Or, may conduit be run to such boxes without being sealed at the pumps, if they were sealed in the underground run adjacent to the pump island?"

A. Where rule 3203c mentions "in which arcing or sparking is likely to occur" it means where sparking or arcing normally does occur in the customary operation of the device. It does not include a junction box, and the Code does not require that a junction or pull box be sealed off. However, the conduit as it leaves the switch box in the pump should be sealed off. Also the conduit as it leaves the pump should be sealed.

Q. 2. The Crouse-Hinds Catalogue, Bulletin 2520, gives two gasoline pump wiring diagrams on page 46 and I note the absence of sealing conduits at the junction boxes shown in the lower parts of the pumps. Is this correct according to 3203-c?

A. While the sealing of the junction box is not required (altho it is desirable) it is required that the conduit leaving the pump be sealed. A sealing fitting just below the junction box would effectually seal off both the box and the conduit.

Q. 3. In these diagrams sealing fittings are used at the panel board inside a building. These seal the conduit at the panel board enclosure, yet at the

Electrical Contracting, July 1937

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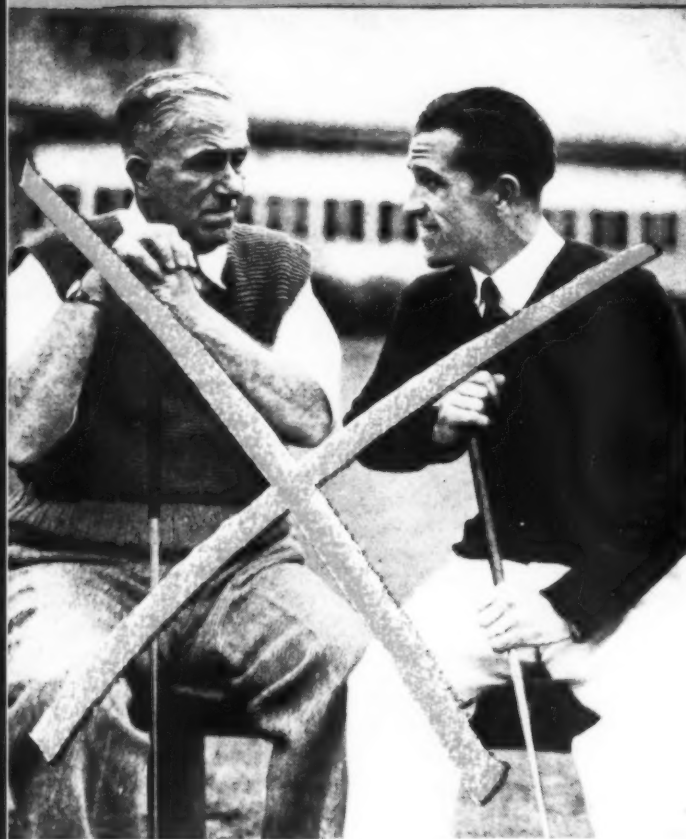


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Questions ON THE CODE

[FROM PAGE 94]

junction box enclosure in the pumps the conduits are not sealed. In the pumps being installed in this vicinity including gasoline pumps, both the lighting switch enclosure and the motor control switch enclosure are sealed by the manufacturer. My contention is that such pumps should have conduit entering or leaving junction boxes sealed. Is this correct?

A. No, as we have said above, the junction box does not need sealing, but conduit leaving the pump does.

Q. 4. I believe that where a conduit run leaves a hazardous location and enters a non-hazardous location the conduit should be sealed in the non-hazardous area adjacent or as close as possible to the hazardous area. According to this idea, the sealing fittings shown at panel boards in the above mentioned diagram, should be advanced along the conduit runs close to the pump island. Is this correct? Our local inspection department requires that sealing fittings be placed in conduits at junction boxes under the pumps, but the above information is required for suburban towns and villages where there are no local requirements.

A. As the rule covering this deals with the hazardous area, the requirement is that the seal between the hazardous area and the non-hazardous area be in the hazardous area as close as possible to the non-hazardous area. The sealing at the panel would prevent fumes reaching the panel which may originate in the underground conduit, from gasoline which may soak through the ground. As sparking and arcing do occur in panel boards these conduits should be sealed off.

Nine Wires in a Conduit

Q. "Will you please answer in your next issue why only nine wires are permitted in one conduit?"—E.J.E.

A. This requirement was developed in order to prevent excessive heating of conductors in one conduit. When electric current passes through a conductor, heat is developed in the conductor in proportion to its size and the amount of current. If the conductor is bare and held free in the air, the heat developed naturally, is easily radiated away from the conductor. If the conductor is covered with rubber insulation the heat is not so readily radiated. If the rubber covered wire is enclosed in a conduit the radiation or dissipation



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Questions ON THE CODE

[FROM PAGE 98]

of heat is further retarded and the higher temperature is maintained in the conductor. If more wires are added in the conduit there is still greater heat developed and the temperature reached may cause rapid deterioration of the rubber insulation.

The number of nine wires as the maximum, which may be run in one conduit, was arrived at as the greatest number from which sufficient heat could be dissipated, when the wires were carrying their rated capacity in amperes, that the temperature reached within the conduit would not be deleterious to the insulation.

Automatically Started Motors

Q. "I have heard that there is a new ruling in New York City for oil burner motors, which requires that a new type of fuse be used. Can you explain this for me?"—H.E.B.

A. The ruling referred to is not a new ruling but one that has been in the National Electric Code for the past few years. The inspection authorities in New York City feel that this rule should be in force and should be complied with.

The ruling is found in the second sentence of Exception 1 to 808c in the Code and this reads as follows: "Motors of $\frac{1}{4}$ to 1HP which are started automatically, unless provided with inherent overheating protection, shall have the running protection required by paragraph C of this section, modified to allow protection at 140 per cent of the rated current of the motor."

The inherent overheating protection device is one which is placed in contact with, or within the frame of the motor and is actuated by the heat of the motor, to interrupt the current to the motor. The device itself is not actuated by the current flowing in the circuit.

In proportion to the number of automatically started motors in use but few of the motors have as yet been provided with this inherent overheating protection. Compliance with the rule, where the overheating protection has not been provided, will require the use of a thermal device or a time lag fuse as the ordinary fuse rated at only 140 per cent of the ampere motor rating will not stand the initial starting current of the motor. Also the ordinary fuses are not generally available in sizes to meet the 140 per cent requirement. Time lag fuses are available in many sizes.

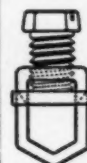
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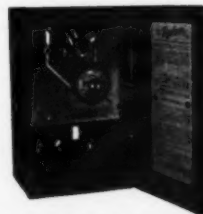
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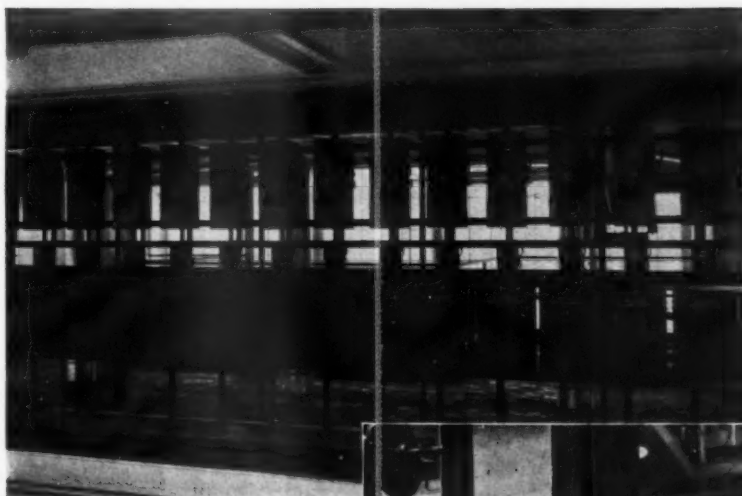
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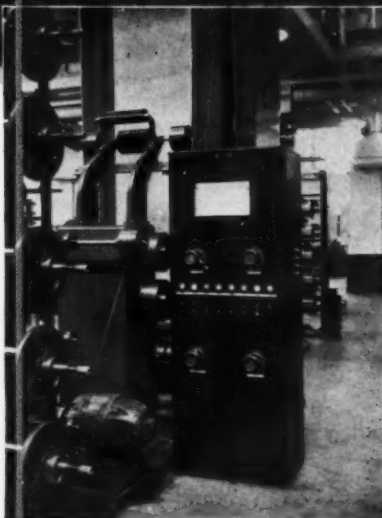
Proper functioning of control equipment is one of the electrical maintenance man's major responsibilities. Here are some pointers on selection and maintenance. . .



JUST PUSH THE BUTTON THE REST IS AUTOMATIC

Master control for the temperature of the tower and enamel and for the speed of the wire in this Westinghouse wire enameling department is placed next to the production equipment, it is enclosed in a steel cabinet with indicating lamps.

The automatic heater control equipment, (upper illustration) actuated by the master control, is mounted on a balcony to conserve floor space.



Drives and electrical distribution have been discussed in previous issues of this section. Fully as important as these two phases of the electrical maintenance man's responsibilities, is control.

Power companies usually limit starting currents to definite values based on the motor size or plant capacity. Where power and lighting are supplied from the same transformers, it is desirable to keep the starting currents as low as possible in order to prevent flickering of lights. Thus, it is quite possible that in many cases the type of control required by starting-current limitations will determine the type of motor to be used.

SELECTION POINTERS

Five principal functions of control may be listed as follows: (1) To connect the motor to the power lines; (2) to keep starting current within desired limits; (3) to permit quick, smooth acceleration; (4) to provide speed control; and (5) to disconnect the motor in case of undesirable operating conditions.

Wherever possible, it is desirable to use full-voltage magnetic starters because of their simplicity, flexibility, and low first cost. However, when even the low starting current of a line-start type of motor is more than permissible, a reduced-voltage starter is required.

1. Consider Torque

Torques of a.c. motors vary as the square of the voltage, so that if a starter reduces voltage to 80 per cent,



SAVES FLOOR SPACE

Consolidation of automatic control panels for wax paper printing machines at the Kalamazoo Parchment Co., Parchment, Mich., increased available floor working area, and made maintenance more convenient by putting all panels at one location.

Three-phase, single-phase and d.c. power lines are all brought through a tunnel to a basement of the building. At the tunnel exit the automatic control panels are mounted and the power lines run to the panels.

"FOOLPROOF" CONTROL

"Foolproof" control was a necessity when Lerner Stores, Inc., entered upon its air-conditioning program. The firm operates women's apparel shops in all parts of the country. Store managers are women, with no mechanical aptitude.

Control in every Lerner air-conditioned store, therefore, consists of only two push-buttons. One starts up the blowers for the ventilating system, which is run all day. The other turns on refrigeration whenever the manager feels it is necessary. Everything else—heating in winter, humidity, amount of outside air intake, and the like—is fully automatic. A local contractor in each community takes care of periodic inspection and servicing.



the starting and accelerating torques are lowered to 64 per cent of rating. When control is selected, these facts must be considered in relation to the load driven by the motor.

The auto-starter, or compensator, gives higher torque for the starting current than the resistance and reactor types; but because the motor circuit is opened in transferring to full voltage, it creates more line disturbance than the latter. Resistance starters are usually recommended for small motors, compensators for medium sizes, and reactors for large motors. Direct-current motors, except in small ratings, require line-resistance starters.

It is not good practice to attempt more than 50 per cent speed reduction by resistance, because small changes in the load might bring about large changes in speed. Therefore, for drives of widely fluctuating load, such as reciprocating compressors, multi-pole a.c. motors or field-controlled d.c. motors are preferred.

Speeds of d.c. shunt motors are increased by decreasing the field strength or inserting resistance in the armature circuit. These controls can be separate or incorporated in a single speed regulator.

2. Protection

It should be remembered that motor controllers are designed to take care of normal operating conditions. As a rule they should not be expected to protect against short circuits. A circuit-breaking device of proper capacity should, therefore, be placed in the line ahead of every starter or group of starters. As a safety precaution for anyone working on the equipment, a safety-type disconnect should also be placed ahead of individual controls and next to the motor.

Protection against overloads is usually provided by thermal relays, which are heated by the current going into the motor. Low-voltage protection disconnects the motor in the event of voltage failure or excessively low voltage. This type of protection is essential for such drives as line-shafts and machine tools for the protection of equipment and operator.

MAINTENANCE POINTERS

Contactors in control devices must be able to "take it." The frequency with which they must operate may range from occasional makes and breaks to as many as hundreds of operations a minute. They may have to open short-circuits where currents are hundreds of times the continuous current rating.

3. Checking Contactor Tips

Excessive resistance at the contacts

may be the cause of very high temperatures—100 to 200 deg. C—at rated current. The most likely point of such excessive temperature is where the moving tip makes contact with the stationary tip. However, high resistance may also occur at any one of the bolted joints on a contactor, especially if the contactor has previously reached a high temperature.

A millivoltmeter can be used to find which joint or contact has a high voltage drop across it. When the contact, with an excessive millivolt drop, has been located, it should be opened and the oxide removed with a file (not sandpaper or carborundum paper).

It should be a simple matter to inspect contact tips weekly or monthly, and, if the temperature is unduly high, to give them a few strokes with a file. Millivoltmeter checks should not be necessary in such routine inspections.

A word of caution should be inserted here, however: Many maintenance men file contact tips whenever they are rough. Mere roughness is not a sign of poor contact—unless of course, the tips are badly pitted. In general, the tips should be filed only if the contactor is heating up.

If it is not practicable to keep contact resistance low by filing, a silver face can be brazed on the two tips so that contact is made through that metal. Silver contacts are self-purifying.

Excessive wear on contact tips indicates frequent operation. Usually this type of service will not develop high resistance unless operation is so severe as to cause very high temperatures. Silver should not be used on the contacts for such service, because it will not stand up; however, a special alloy is available for this purpose.

4. Coil Trouble

Most contactor coil troubles can be traced to overheating. Care should be taken that the coils are wound for the voltage that exists on the line, especially if room temperature is high.

5. Relays

Many relays must operate on a time basis. One of the most common of these is the dash-pot type, in which movement of the solenoid is retarded by an oil dashpot. To overcome trouble caused by dirt and gum, the dash should be cleaned frequently, say once a week or once a month, depending upon local conditions. This attention will also keep corrosion down.

Where dashpot relays are used in connection with motor control, trouble is sometimes experienced because of tripping while the motor is starting, or shortly after it gets up to speed. A

(Continued on page 106)

ELECTRICAL MAINTENANCE GUIDE SHEET

APPLICATION CHART FOR CONTROL

TYPE	DEVICE	OPERATION	APPLICATION
Overload Protection	Fuse	Opens a circuit when ampere load exceeds fuse rating.	Circuit protection.
	Circuit Breaker	Has wide range of settings; opens circuit when current reaches value of predetermined setting; easily reset.	For circuits of large capacity; also in a circuit that overloads frequently.
	Relay	Device which serves to make or break a pilot circuit which in turn causes opening (or closing) of circuit breaker or magnetic contactor. Three major types: Dashpot, thermal, and escapement.	Connected in motor circuits, sometimes with current transformers; protects effectively against short circuits, grounds, etc.; used as overload protection for induction motors.
Undervoltage Protection	Coil	Energized coil holds circuit closing device in place; low voltage causes device to be released which in turn opens circuit and stops motor.	Included with manual and automatic control; prevents motor starting again, when power is restored, until operator closes circuit.
Limiting Starting Current	Resistor	Inserted in series with motors; controls voltage applied to motor by IR drop.	For reduced voltage starting of motors—usually $\frac{3}{4}$ hp. d.c. and over.
	Reactor	In an a.c. circuit controls voltage applied to motor by means of impedance drop.	For starting a.c. motors larger than 5 hp.; also for starting polyphase induction motors.
Phase Failure Protection	Relay	Device on which, when one phase of motor circuit opens, the single-phase action causes contactor to open, which disconnects motor.	For protection against single-phase operation of motor.
Phase Reversal Protection	Relay	One type operates on induction principle, wherein a torque rotates a movable element and maintains a contact; another type combines two voltage relays, opposition of component currents causing relay to remain open.	Prevents motor starting in opposite direction.



Benjamin "DUO-SERVICE" Floodlight

Constructed on the original Benjamin two-in-one principle which combines in the same unit, a large porcelain enamel diffusing reflector with a beam-producing inner floodlighting projector, the Benjamin "Duo-Service" Floodlight meets the modern requirements of floodlighting gas-line service stations, super-service stations, roadside inns, etc., by providing:

A. Adequate uniform general illumination of grounds, drives, entrances, pump islands and service areas, from the large diffusing reflector.

B. With simultaneous, high intensity floodlighting of the building to several times the intensity on the ground, by means of the beam projector.



Illustrating the famous Benjamin projector which provides, from the the projector, kinds of floodlighting for effective illumination—ground from the large porcelain enameled building floodlighting and the inner

Three Types of Inner Projectors

The Benjamin "Duo-Service" Floodlight provides three distinct types of inner projectors.



Benjamin "PLAY-AREA" Floodlight

Designed to provide the highest quality of illumination for outdoor sport and recreational areas, the Benjamin "Play-Area" Floodlight combines a large open-type, diffusing, porcelain enamel steel reflector with an inner auxiliary reflector of oxidized aluminum to produce high initial efficiency and effective control of the light.

Illustrating two of the able; from left to right Arm Bracket with Pipe Wiring Pole.

Because . . .

... EVERY ONE of the Benjamin Floodlights is specifically designed to meet a definite floodlighting requirement. Thus, from Benjamin's complete line of Porcelain Enamel and Alzak Aluminum Floodlights, it is possible to select a floodlight which gives the most suitable type of light distribution and performance required for the job. This, plus Benjamin's exclusive features of design, efficiency and durability, make it good business to Think of Benjamin when you Think of Floodlighting.

- ☐ SERVICE STATION MANUAL
- ☐ EFFECTIVE LIGHTING OF NIGHT SPORTS
- ☐ BASEBALL MANUAL
- ☐ DESCRIPTIVE BULLETINS



Benjamin Electric Mfg. Co., Des Plaines, Ill.
SEND FLOODLIGHTING INFORMATION CHECKED ABOVE

Name.....
Address.....
City..... State.....

Send Today for "Service Station Lighting Manual" and "Guide to the Effective Lighting of Night Sports" containing lighting layouts and other up-to-the-minute information on Floodlighting. Read for yourself why Benjamin leads in floodlighting of Service Stations and Outdoor Sports Fields. Benjamin Electric Mfg. Co., Des Plaines, Illinois.

BENJAMIN

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Distributed Exclusively

heavier oil may correct this, but if not, it may be advisable to replace the relay with a temperature-type of overload relay.

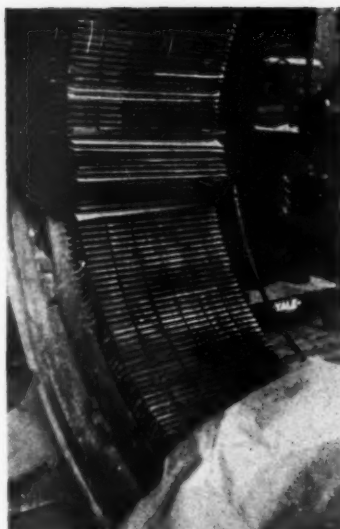
If a temperature-type overload relay does not function correctly, it can be immersed in a pail of water kept at the desired temperatures and adjusted so that it will just trip.

A temperature overload relay does not need much maintenance, but certain precautions in connection with its use should be preserved. It should not be placed in a strong draft, because it is sensitive to temperature. If a draft cannot be avoided, the relay should be shielded by a cover.

Bearings Failure Causes Coil Damage

It was necessary to replace 102 coils in this large stator, after the failure of bearings caused the rotor to rub and chew up a large part of the laminated core. After the damaged coils had been removed then came the tedious job of straightening the slots and making them smooth enough to permit the installation of new coils.

An industrial plant was seriously handicapped by the failure of this 450



STATOR CASUALTY—Bad bearing caused rotor to damage 102 coils in this 450 h.p. motor.

hp., 435 r.p.m., 3-phase, 2200-volt motor and the time lost, plus the expense to move and repair would have paid for many and frequent bearing inspections. It's a warning. This photo was taken in the service shop of the H. N. Crowder, Jr. Company, Allentown, Pa.

Electric Instruments In Plant Survey

How valuable an instrument-conducted survey of plant electrical conditions may prove to be is shown by the findings of R. C. Hodges, electrical engineer of the Titanium Pigment Company, Sayreville, N. J., who recently made load tests on 800 motors in 40 of his company's departments.

Many motors were found to be overloaded. For example, the same horsepower-size motor that was previously satisfactory on a low-speed pump had been put on a higher-speed pump of the same size. Other motors were found to be underloaded with resultant poor efficiency and low power-factor. In some cases motors were—or will be—interchanged; in other cases, replaced.

Data obtained in this survey are considered to be valuable for two reasons. First, the findings help in keeping the plant running on its 7-day-a-week, 24-hour-a-day schedule, by having the right motor for every job and accurate relay setting on the control. Second, the motor records have aided greatly in laying out the new equipment for a large plant extension. Much of this equipment is special, and accurate data were not available before this complete survey was made.

About 90 per cent of the tests were made without breaking circuits. But only simple testing equipment was used—two ammeters, a voltmeter, a volt-ammeter, a recording ammeter, and two current transformers.

Besides using instruments for motor-load tests, Mr. Hodges also puts them to work frequently to check unusual conditions. For example, a motor driving a vacuum pump tripped out. Tests showed the motor was all right, the pump at fault. Again, when a transformer overloaded, a recorder traced the causes to a heater and a gang of electric ovens. In many instances, too, instruments are permanently installed on motors, such as on those driving agitators, enabling operators to keep mixtures at the proper consistencies.

Rays From Lamp Retard Mold Growth

Low-wattage gaseous conductor lamps have been devised to produce radiations which kill mold spores in air. These "Sterilamps" increase the mold-free life of meats, pastry and other foods subject to storage.

An installation was made for Beinecke Ottman Corp., New York City. Under germicidal rays, 1,400 lb. of beef was aged in three or four days, whereas, three to five weeks was formerly re-

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AIR CAPACITY
Low Power Cost
EXHAUST FANS

CASH in on the growing exhaust fan business
with Peerless Exhaust Fans. Low in price,
they give you these distinct selling advantages:

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- Special thrust bearing for horizontal or vertical mounting
- 10-inch to 30-inch sizes

Write for a copy of Bulletin 312 that gives complete data.

THE *Peerless*
ELECTRIC COMPANY
WARREN, OHIO



"THE COMPANY
KNEW THEIR
STUFF WHEN
THEY ADOPTED
HARVEL
OIL STOP"

"I'LL SAY ...
IT'S EASY TO
HANDLE AND
IT LASTS FOR
YEARS"



HARVEL OIL STOP

... Is a polymerized phenolic resin chemically reacted to an insoluble stage at point of application without the necessity of heat, pressure or the use of solvents. It is acid and alkali proof, heat resistant, OIL PROOF, safe and easy to handle, and STOPS OIL LEAKS.

This cable splicing material is free from solvents, therefore can be used within the body of built up insulations without waiting for solvents to evaporate, and without the hazards resulting from vapor pockets. Eliminates the use of junctions, waxes, and pot heads.

OIL STOP APPLICATIONS. Stop joints on oil impregnated paper insulated power cables—Terminal seals on oil impregnated paper insulated power cables—Water tight seals on rubber insulated cables—Oil tight seal in connecting rubber insulated cables to paper insulated cables.

Write today and learn about HARVEL OIL STOP, it does as its name implies . . . IT STOPS OIL LEAKS.



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IRVINGTON VARNISH & INSULATOR CO.
IRVINGTON, NEW JERSEY, U. S. A. *Est. 1905*

VARNISHED CAMBRIC • VARNISHED CAMBRIC TAPES • IRV-O-SLOT • VARNISHED CANVAS
VARNISHED SILK • FLEXIBLE VARNISHED TUBING • VARNISHES AND COMPOUNDS

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Trade-Mark
TORCHES
AND SOLDERING
IRONS...ideal for
electrical work



● *Prest-O-Lite* Torches and Soldering Irons are available in convenient and moderately priced outfits, covering every open-flame or enclosed-flame requirement of the electrical contractor. These appliances are economical equipment for soldering, heating and brazing.

Prest-O-Lite appliances operate on *Prest-O-Lite* Gas, which can be obtained conveniently in small tanks at any of the thousands of *Prest-O-Lite* Gas Exchange Service Stations. You exchange your empty tank for a full one and pay for the gas only.

Your jobber will gladly demonstrate the many features of *Prest-O-Lite* equipment. Call him, or write the Linde office near you.

THE LINDE AIR PRODUCTS COMPANY
Unit of Union Carbide and Carbon Corporation
UCC
New York and Principal Cities
In Canada:
Dominion Oxygen Company, Limited, Toronto

quired. Temperatures between 55 and 58 deg. F. and humidity of 90 to 100 per cent were maintained.

Sterilamps operate on alternating current. A small transformer is the only auxiliary equipment required, from which as many as three lamps may be operated. Power consumed by two lamps and the transformer amounts to about 25 watts.

Savings can be realized by this process because trimming losses are reduced. The only trimming necessary when meat is aged under these radia-



GERMICIDAL LAMP—Meat aged in three or four days, at higher temperature and high humidity.

tions is removal of the dark surface film. Loss of weight is largely eliminated, since maintenance of 90 per cent or higher humidity is permitted. Other savings are made in refrigeration costs. Meat can be aged at 10 to 15 deg. higher temperature and in about one-third the time, thus reducing the storage space required.

In the baking industry the lamp has been used to retard mold growth on cakes. It has been found that exposure to the rays has lengthened the mold-free life of cakes from 1½ to 2 days under adverse conditions. In some instances spoilage was reduced from 15 per cent to 1 or 2 per cent through use of the lamps.

Flexibility of Production With Torque Drive

A manufacturer in western Pennsylvania has equipped several production machines with torque drives. This type of drive is used for flexibility. It is a unit attachment and consists of a motor with V-belt drive and a driver pulley. The assembly is pivoted so that the weight of the motor keeps a tension on the belt from the driver pulley to the driven pulley on the machine.

Since torque drives have been installed, the company has been able to put larger jobs on the machines and has eliminated several belts from overhead shafts. Also, machines now have individual drives and can be rearranged in the production line.

MICABOND

THE IDEAL INSULATION FOR

Spacing and insulating the copper bars of commutators, and for insulating rings, cones and cores.

Discs, washers, bushings, bands and many varied shapes used in all types of electrical power and lighting equipment.

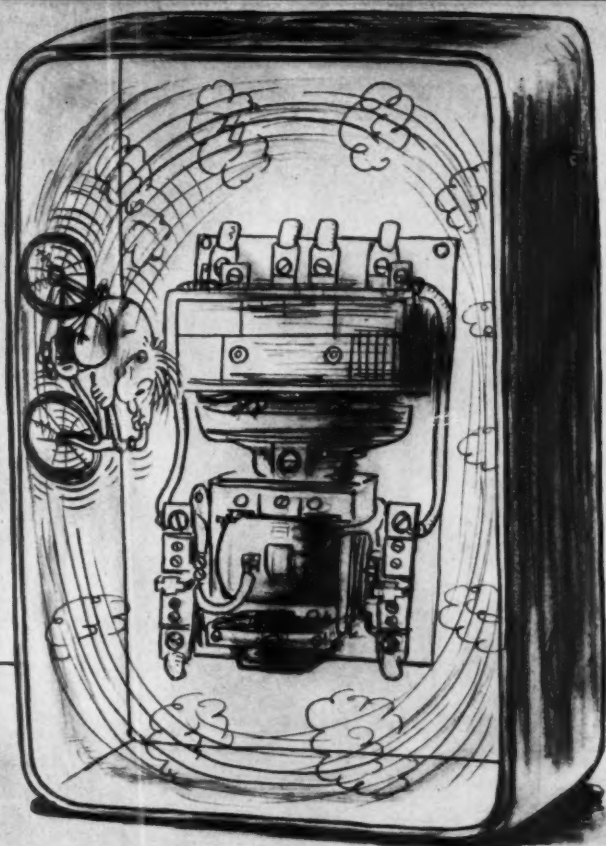
Tubes for induction coils, commutator sleeves, rheostat rods and other general high potential insulating applications.

Separating the plates or leaves in electrical condensers and transformers of practically every type.

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It is mica in its most usable form, with high dielectric and mechanical strength. It is practically non-hygroscopic, chemically inert, and is easy to punch, cut or form. It has high heat resistance. Micabond is supplied in many grades and forms for each specific insulating need. Let us send samples to meet your specifications.

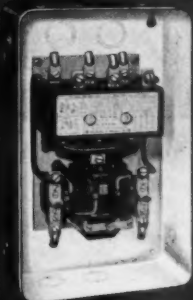
**CONTINENTAL-DIAMOND
FIBRE COMPANY**
NEWARK, DELAWARE



***"Just because there's lots of room,
Philbert wants to be a daredevil!"***

There is only one starter in which Philbert could do his stunting—that's the Allen-Bradley solenoid starter. No other starting switch provides such extra large wiring space. This extra room is made possible by the compactness of the solenoid unit. Yet, compact as it is, current disrupting capacity has not been sacrificed. While the Allen-Bradley solenoid starter is the smallest starter on the market, it easily disrupts currents of at least ten times its maximum horsepower rating. Its construction is unusually rugged. Write for "The Story of the Solenoid Starter."

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL



"But Why a Solenoid Starter?"



"Because only the true solenoid starter, such as the Allen-Bradley, gets away from the pivots, hinges, and other trouble-making features of clapper starters. No starter can be more simple than the solenoid type, in which the contacts are closed directly by the plunger."

● COMPACT

Though very compact, this starter easily disrupts currents of not less than ten times its maximum hp rating.

● CONSISTENT

Operation is frictionless, fast, and consistent in speed. There are no pivots to become sticky and delay the action.

● NO SHUT-DOWNS

The A-B solenoid operates at line voltages far below normal, assuring positive contact pressure at all times and preventing motor shut-downs.

● NO BURNING

The straight up and down motion of the solenoid permits using totally enclosed, double break contacts. Arcs are instantly suppressed.

● NO CONTACT MAINTENANCE

The straight line motion prevents contact rebound and thus practically eliminates contact burning and welding. The double break, silver alloy contacts never have to be cleaned or "dressed." They are always in perfect operating condition.

SEND FOR "THE STORY OF THE SOLENOID STARTER"

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Please send "The Story of the Solenoid Starter."

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ALLEN-BRADLEY

SOLENOID MOTOR CONTROL

Allen-Bradley Bulletin 705
IN 5 SIZES

BULLETIN 705 REVERSING SWITCH FOR SQUIRREL-CAGE MOTORS

For automatically reversing squirrel-cage or slip ring motors. Utilizes two Allen-Bradley solenoid starting switches, mechanically interlocked. The double break, silver alloy contacts require no filing or "dressing." Thermal relays provide accurate motor overload protection. This rugged starter is suitable for the most severe operating conditions.

Special Enclosing Cabinets

Water-Tight	Dust-Tight (Class 2, Group C)	Dust-Tight	Explosion-Proof (Class 1, Group C)	Oil Immersed
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Looking In On Ralph Walker

[FROM PAGE 19]

intendent on the ground, set up an office and ship materials direct. Each superintendent has a gang of men who like to work for him. They all have cars and drive in and board locally. There are about 150 men steadily employed, in the construction department. The general superintendent inspects the job. So does Walker. So does White, out of Columbus. Ralph and K. D. both sell and they have salesmen located in Greensboro and Spartanburg to cover North and South Carolina on construction projects. In addition, they travel nine men through the country, selling their manufactured products on commission.

But Ralph is the main bacon bearer. He likes to get business. He does it well. He has an easy manner, a friendly personality. Men like to work for him. He doesn't order them around. Men trust him with their jobs. And he comes through.

White told me this amusing story. Long ago, when they first started after large orders, a big job broke in the south. It was big money for them—a large branch of a very toppy western outfit. But Ralph's father-in-law knew their head man, so he pulled wires in Chicago. Then Ralph and K. D. took their popguns and went after it—eager but scared. When they went in with the bid, the local executive read it and was all smiles. Ralph and K. D. got prickly heat and shivers. They thought they must have figured too low, left out the labor or something. So they withdrew their bid and later found that orders had come from the west to treat 'em right—no foolin'! But it taught them something about selling. Now, they take it in their stride.

Textile Specialists

They have also learned that there is lots of profitable business, with no competition, waiting for the contractor who wants to do something for his customers. Much of their work comes from big plants, where they have pointed out economies possible through modernization, and have been told to go ahead. Also, their long experience in cotton and rayon mills has made them specialists. But they do not pose as an engineering firm. They are contractors. But they have ideas. And so their business has grown, until it rates among the twelve or fifteen largest in the country.

White and Walker, all this time, have worked together like a pair of good

gray horses, and there has not been a quarrel. And that is a pretty good testimonial to both of them.

In spite of all the work, Ralph has also been deeply interested in industry promotion. For the last three years, he has devoted almost one-third of his time to cooperative work. He is a good thinker and a good mixer and gets things done; and so when he called this conference, they turned out and they liked it. In fact, the only complaint I heard, around the Atlanta Biltmore that week, was from Earl Peak.

It seems that Walker has not played golf in two years. And there it was March, with the apple blossoms out, and the Judas trees in color and the peonies bursting through the ground and fat robins raging around scaring women and children. What could a man from Iowa do?

So Peak went out with Charlie Swartzbaugh and another victim and shot some eighteen holes. But Ralph came in in ninety something—or was it eighty?—and put the national president to shame. Ho-hum! Some of the kibitzers told me it was a great slaughter. But Ralph just smiled.

More GOSSIP

Contract Hazards

Municipal jobs sometimes entail considerable uncertainty for the contractor who bids and apparently has the job in the bag. For instance, the Morganstern Electric Co., Inc., of Pittsburgh, had its \$52,582 street lighting bid accepted, and officials of Coraopolis Borough passed an ordinance awarding the contract. When lower energy rates were later received from the local power company, however, this ordinance was repealed. A suit brought by the Morganstern Company to collect for its estimated profits in this contract was recently decided against the contractor in the Pennsylvania Supreme Court. Since this suit was started, various phrases in the specifications were found not in accordance with the Borough Code. This would have made the contract illegal. Moral: It pays to check up the legal side of municipal contracts.

Too True!

According to Herbert Evans of Nicholas Electric Co., Los Angeles, a committee is a group of men who spend hours and keep minutes.

Youngsters Practice

Charlie Schumacher, shop foreman of the B&P Electric Co., Cleveland, believes that youngsters learn the fundamentals of connecting motor windings more readily if given a whirl, on their own, as early as possible. Some old equipment in the B&P shop is turned over to the juniors for this purpose, and it provides good training.

Machine Skill

New men start learning about machine work when they enter the motor repair shop of the Robertson Electric Construction Co., Buffalo. Shop superintendent Witschi says every mechanic must drill and tap holes and do many other similar jobs later on, so he begins with mechanical training.



HUNTINGTON UBER ALLES—

After dabbling in steel construction in India, South America and in other spots about the world, E. F. Beckmeyer built the International Nickel plant in Huntington, West Va. It took 4½ years and he liked the town so well, he decided to settle down there. Being a Penn State man with both a mechanical and electrical education, he set up shop as a contractor in 1923. The Beckmeyer-Davis Co. not only does electrical work, but C. W. Davis (center) looks after plumbing, heating and air conditioning. J. O. Haskins (left background) has charge of electrical construction and estimating department.

Association Hints

One of the veteran association managers of our industry, who held his group intact during the darkest days of the depression, says it is all very simple. Here are some rules that rank first and foremost, whether business is good or bad:

(1) Keep personalities out. Don't try to make a gushy fraternal organization out of a strictly business association.

(2) Avoid attempts to mix the wives of members. Some have a decided inferiority complex. When feelings are hurt at social functions, this provokes bad blood between husbands.

(3) It is hard to get cooperation and to make healthy progress by using force.

Questions on SIGNALLING and COMMUNICATION

Answered by ALBERT A. SCHUHLER

Test Station in Coded System

Q. It is desired to test a fire alarm system occasionally from the principal's office in a school. The system now installed is of the plain code type using two wires for the coded stations, and two wires for the single stroke gongs.

We do not want to use another station for this purpose, but instead, some simple device to enable one to send any desired manual signal. What would you suggest, and how may this device be connected in the circuit?—F.L.

A. Use a fire alarm push button switch, or strap key station. The push button switch is usually mounted on a single gang switch plate, having an operating plunger protruding through the front. The strap key station is usually enclosed in a small cast iron housing and is equipped with a cylindrical lock, so as to give access only to authorized persons. The interior of this station is equipped with a special button of the strap key type.

Either of these two units may be connected in series with the fire alarm station loop. They must be of the closed-circuit type, so as to normally close the station loop. When the plunger or strap key is pressed, the circuit is opened. A code or test may be made by pushing the contacting unit any pre-determined number of times. Whatever code is selected in this manner, will be transmitted to the single stroke bells.

Increasing Life of Low-Tension Lamps

Q. Is there some method whereby low-tension lamps may be prevented from burning out rapidly in annunciators?—L. W.

A. Perhaps the best method to follow in increasing the life of low-tension lamps, is to use a lower secondary tap of a transformer. Most lamps of that type are made to operate over a range of voltages, such as 12 to 16, or 18 to 24 volts. In the first

case 12 volts, and in the second case 18 volts would result in satisfactory operation. Where a transformer has no intermediate taps, it will be necessary to use lamps designed for a slightly higher voltage than that delivered by the transformer.

Contacting Devices For Lamp Annunciators

Q. What type of push buttons or other contacting devices are used in lamp annunciator systems?—S.E.

A. Either momentary contact push buttons, tumbler switches or knife switches may be used to operate lamp annunciators. When momentary contact push buttons are used, remote control and locking relays of the electric reset or manual reset types are also used.

With locking type push buttons, no relays are necessary. Resetting is accomplished by means of a collar or sleeve around the push button plunger, or by means of a separate smaller plunger or key. When tumbler switches are used, no relays are necessary. Operation of the tumbler in one direction operates the lamps, and when tumbler is



returned to original position, lamps are extinguished.

Knife switches are rarely employed, but when used, the closing of the switch lights the lamps, and the opening of the switch extinguishes the lamps. No relays are used in this system.

Figuring Transformers For Nurse and Staff Systems

Q. What is the basis upon which transformers are selected for nurses call and In & Out systems?—F. L.

A. The general practice followed by signalling equipment manufacturers is to figure approximately one-third of the total load on nurses call systems, and from three-fourths to full load on In & Out staff systems.

Seldom, if ever, does the operating load exceed one-third of the total possible load in nurses call systems. But on In & Out systems it is quite possible to have all members of the staff present at one and the same time, and therefore, full load must be carried. Where this condition does not exist, the common practice would be to figure on three-fourths of possible total load.

Lamps used in these systems require from 3.1 to 4.0 watts each. The transformer should be calculated on this basis, taking the above factors into consideration. As an example, a nurses call system has 125 lamps. The total load would be 125 lamps \times 4 watts or a total of 500 watts, one-third of 500 watts would be approximately 167 watts. A 250 watt transformer is the next standard size.

Motor-Generator Set for Charging Battery

Q. What method is followed in calculating the proper size of motor-generator set for charging a battery in signaling systems?—E. W.

A. For charging a battery, multiply total number of cells (voltage of battery \div 2) required by 2.6 (charging voltage per cell) and multiply this result by the rate of discharge of battery to be used. For example, assume that the battery to be charged is one having an output of 10 volts, 60 ampere-hour, we determine the proper generator as follows: 10 (volts) \div 2 (volts per cell) equals 5 (number of cells in battery)—5 (cells) \times 2.6 (charging voltage per cell) equals 13 (charging voltage of battery).

Rate of discharge of battery is based on 8 hours so that a 60 ampere-hour

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Adequate

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Modernize Existing Buildings

Outlets
may be
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2100C Cover scored
to facilitate installation
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A small sturdy Plug
Receptacle (No. 2127)
with finding grooves
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Flush mounted
cover.

Adequate

For

Tomorrows Requirements

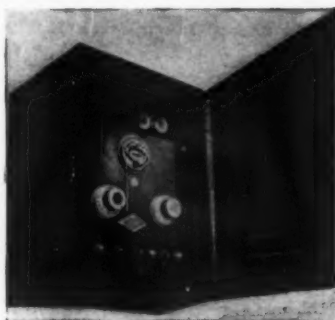
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2100B Channel has
knockouts for $\frac{1}{2}$ inch
Conduit every 8 inches.

Channel has a
capacity for 6
No. 12 wires.

THE WIREMOLD COMPANY

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Replace troublesome batteries
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TELENCO ELIMINATOR

Use it for telephone systems, inter-communicating phones, dial systems, relays and other devices that require a low voltage, pure direct current.

- No chemicals or moving parts.
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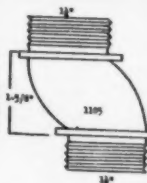
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OFFSET NIPPLE*

which permits mounting of switches, gutter outlet boxes and other equipment where knockouts don't line up.

* Patent applied for.



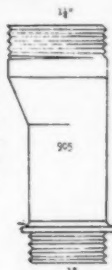
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Made of aluminum alloy with a high polish finish. Built to hold heavy reflectors at any angle. Neat in appearance—easy to install.



REDUCING ADAPTERS

Adaptable to the Westinghouse meter socket: 905 is an eccentric type which by turning, will line up the meter socket with the switch, making a flush mounted job.



B. HARTMAN 168 SUNSET ST. LONG BEACH, CAL.

Questions on SIGNALLING and COMMUNICATION

[FROM PAGE 112]

battery would have a discharge or charge rate of 60 (ampere-hours) ÷ 8 (hours) equals 7.5 amperes. Therefore, 13 (charging voltage) × 7.5 (ampere rate) equals 97.5 (watts required of generator). Since the calculated wattage of the generator is 97.5 watts, a generator of the nearest larger size should be selected. A standard size would be either 100 or 125 watts depending upon the manufacturers product desired.

In and Out System With Time Recorder

Q. A client wishes to install an In and Out register system, in a dispensary, where payment is dependent upon the length of time spent in doing work. It is necessary that some record be made to show the length of time spent in the building. How may this idea be carried out, and what extra wiring and equipment is required?—G. Q.

A. To record time with an In & Out register, add an elapsed time recorder. In addition to a visual signal at the entry on an entrance register, recorded when a toggle switch is operated, a visual signal should be shown on an office indicator. This signal may be at the switchboard. The elapsed time recorder is simply connected in multiple with the lamps at the register or indicator and indicates on a chart the time when a toggle switch is operated by a member of the staff, when he arrives in the building. A record is also established on the chart when the toggle switch is operated upon leaving the building. The elapsed time recorder may be had in either the punch type or the pen-ink type.

Alarm Bell For Coded Fire Alarm System

Q. What type of bell should be selected when adding to a present coded, closed-circuit, fire alarm system now operating on 110 volts 60 cycle a.c.? Is it necessary to make any changes on the fire alarm control panel when a bell is added?—E. M.

A. The bell should be of the single stroke type, having the same general characteristics as the other bells in the system. Such a bell would be wound especially for series operation,

How to locate, diagnose and remedy electrical equipment troubles quickly and accurately

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Troubles of Electrical Equipment

by H. E. STAFFORD

Consulting Engineer

330 pages, 297 illustrations, 22 tables, \$3.00 Contains practical pointers on:

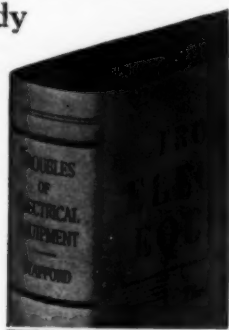
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THE book covers the symptoms, causes and remedy of troubles of both a-c and d-c apparatus usually found in the average industrial plant. Almost every chapter includes also priceless practical hints on efficient operation and maintenance. The book tells, for instance, what power factor is, what it does to an industrial-plant power load, how to control it. It points out the value of a load survey and tells how to make one. It shows how to locate power losses. This practical, how-to-do-it book is an indispensable job manual for the electrical maintenance man. All formulas are illustrated by practical examples and all technical terms are explained in everyday English.



at about 11 volts. A bell wound for 110 volts will not operate, in fact it will prevent the other bells in the series loop from operating.

When an additional bell is placed in the system, care must be taken to see that it does not overload the circuit. Such bells are designed for a maximum of ten to be connected on a 110 volt a.c. circuit.

An adjustment must be made on the compensating bell circuit resistor which is located on the control panel. Therefore, when a bell is added, this compensating resistance must be lowered to the equivalent of the resistance of this one bell. This is done by changing the resistance lead wire from the present tap terminal, to the next lower tap terminal.

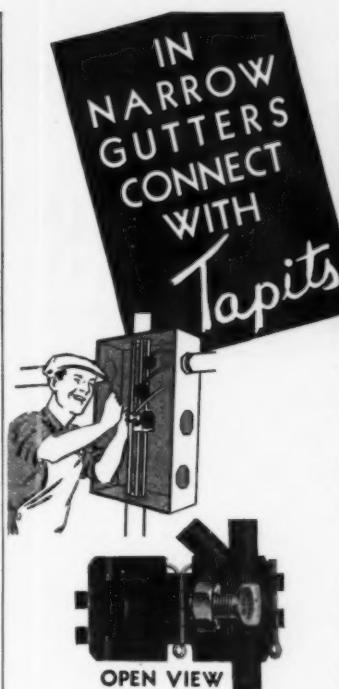
Siren on Coded Fire Alarm System

Q. An industrial plant which now has a plain coded closed-circuit fire alarm system, desires to add a small siren in their yard, so that a fire alarm may be heard two or three blocks away. What type of siren should be selected, and how shall it be connected in the present circuit?—R. B.

A. The best method would be to install a heavy duty type closed-circuit relay, wound for the proper voltage and current, and connect it in series with the bell circuit loop. This would be true in a system having the present fire alarm stations connected in series in one loop, and the bells in series on a second loop. Should the system have the stations and bells all in series on one loop, then a relay of the heavy duty type should be connected in series on this same loop.

The contacts of the relay should be connected with another source of current or circuit, and a coded type of siren approximately one-third horsepower. The magnetic shutter and the armature of this siren should be connected in series, before connecting to the contacts of the relay and the source of current.

Sometimes a small siren, such as the one mentioned above, is connected to the trouble bell relay. However, this practice is not encouraged, as the trouble bell is a part of the control board equipment, and operates from the relay. It should be kept separated from any other signal.



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FLOOR BOXES

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FULLMAN MFG. CO. LATROBE PENN.

High Lights IN THE NEWS

ARBITRATION PLAN IN SAN FRANCISCO

Members of the San Francisco Electrical Contractors Association, Inc. are now operating under an Arbitration Submittal Plan. The action came as a result of three months of study on the part of the Association, by a committee headed by President K. M. Ryals.

Under California law, a group of competitors may agree, in a signed document, to submit all controversies to an impartial arbitrator. This would embrace matters of either law or fact, relative to any infraction of the constitution, by-laws, rules or rulings of the association. Under this law, jurisdiction is rested in the arbitrator to supplant that of any court and a judgment rendered has the same effect as law.

The rules covered under this agreement call for the registration of all jobs, attendance at quantity survey meetings, observance of findings of quantity surveys, and the use of the Pacific Coast Electrical Data and Sales Book as a pricing guide. Competition remains free and open. Liquidated damages for infraction of the rules are decided upon a simple basis by the arbitrator.

The arbitration plan has been operating successfully in a number of industries in California for several years. Several other states have similar legislation, which was originally patterned after a New York law.

NATIONAL ADEQUATE WIRING PROGRAM

The National Adequate Wiring Program will be launched this summer, with the cooperation of the entire electrical industry. Under the slogan "Adequate Wiring—The Big Step to Better Living," local groups will be provided with a national adequate wiring specification based on the Handbook of Interior Wiring Design. A plan book, describing promotional material and a national emblem have been prepared.

A broad, intensive publicity program is under way. Editorial cooperation in national magazines, sound films, newspaper advertising, certification of new homes, cooperation with F.H.A. and building associations has been assured to make this the most effective drive ever held in this field.

The National Adequate Wiring Bureau, which will direct this campaign, has the following personnel—

National Electrical Contractors Association
Ed. G. May—E. G. May Company
S. J. O'Brien—S. J. O'Brien, Inc.

National Electrical Manufacturers Association
W. E. Sprackling, Vice-President—Anacosta Wire and Cable Co.
G. C. Thomas, Jr., Vice-President and Treasurer—Thomas and Betts Co.

Edison Electric Institute
M. E. Skinner, Vice-President—Niagara Hudson Power Corp.
C. A. Eastman, Sales Department—Ebasco Services, Inc. (Bond and Share)

National Electrical Wholesalers Association
John L. Busey, President—General Electric Supply Corp.
L. E. Latham, Vice-President—E. B. Latham & Company

International Association of Electrical Leagues
J. S. Bartlett, Managing Director—The Electric Institute of Washington
George R. Conover, Managing Director—Electrical Association of Philadelphia

PHILADELPHIA SHOW DOUBLED

With sixty-five booths, and products of fifty companies shown, Philadelphia's sixth annual Electrical Progress Exhibit this year received about six thousand visitors from nearly 200 towns. Sponsored by the Electrical Association, the exhibit covered two floors of the Edison Building, with a display of lighting, motors and control, switchboards, precision instruments, wire and wiring devices, "Practical Aids for a Power Age."

Attendance was by invitation only, and included industrial executives, architects, consulting engineers, electrical contractors, wholesalers, utility men and others interested in electrical materials and methods. A gratifying amount of business was closed at the show, and an unusual volume of live leads taken for follow-up.

ELECTRIC WATER SUPPLY

Contractors and dealers contacting rural areas will find much valuable sales and installation material in a new booklet published by the Electric Water Systems Council of Chicago. Primarily intended for dealers who sell and install electric water systems, the booklet points out new and improved methods of increasing business in this field, now that the rapid advance of rural electrification is opening up new markets for electric water systems. Detailed information on where and how to sell and the technical problems of installation under varying conditions are worked out for an aggressive sales program.

MINNESOTA LAW AMENDED

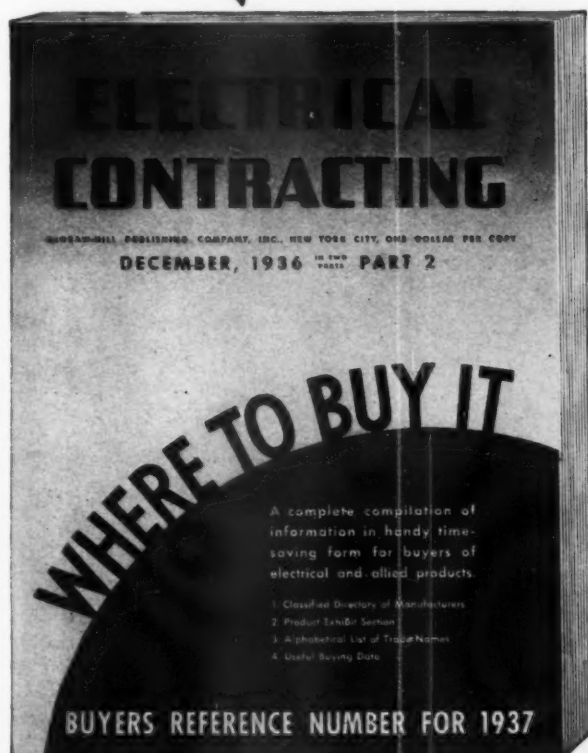
Faced with much rural wiring activity by incompetent and irresponsible persons, in recent years, Minnesota's contracting industry finally won a hard battle. A



MAINTENANCE MEN SEE LIGHT—*Electrical Maintenance Engineers Association of Southern California, visited the Station B, receiving plant for Boulder Dam power at its June meeting. They were guests of the Bureau of Power and Light of Los Angeles. On June 25 it held its annual stag party and social meeting at the Veterans of Foreign Wars Building, Los Angeles. The picture shows their previous meeting on May 18 in which a complete resume of new light sources, lighting fixtures and equipment was presented. The meeting was in charge of E. B. Markee, manager of the South Pacific Division, and J. R. Robertson, illumination engineer, both of General Electric.*

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THE ELECTRICAL BUYERS GUIDE FOR 1937

Electrical Contracting, July 1937

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High Lights IN THE NEWS

(FROM PAGE 116)

statewide licensing bill was passed that sets up requirements for master electricians, journeymen electricians, and for special electricians doing work only on special classes of apparatus or equipment, or who make minor alterations, extensions or repairs to existing systems.

Certificates of inspection are required for work done in any locality, where electrical inspection is available, while contractors must furnish affidavits of compliance with the state regulations, for work done elsewhere. The new law provides for a State Board of Electricity, of five appointive members, whose terms of office are five years. The board's personnel is to be composed of two master electricians, two journeymen electricians, and one consulting electrical engineer or an electrical inspector from a city of the first class.

REA BALKS ON TELEPHONE REPAIR CLAIMS

Rural Electrification Projects involving the construction of new electric distribution systems may produce inductive interference in out-of-date rural telephone lines. But Administrator John M. Carmody, of REA, declared that recent claims by operators of old-fashioned telephone systems for compensation to cover the cost of modernizing their systems, have attained threatening proportions. If the claims are met, some projects may have to be abandoned. In Wisconsin an independent telephone company recently claimed \$6,008 for expenses incurred in modernizing its system.

The problem is also acute in Iowa, Oklahoma and Texas. Wisconsin has declared that a telephone company is not entitled to compensation unless it is ex-

periencing inductive interference in spite of having a modern up-to-date system.

"We cannot recognize the feeling which some telephone companies seem to have that their prior occupancy of a public highway entitles them to collect the cost of modernizing old-fashioned, one-wire telephone systems from later occupants of the same public highway," Mr. Carmody declared in letters to state officials and REA borrowers.

NEW YORK AMENDS SMALL MOTOR RULES

Approved running protection will be required in addition to automatic overcurrent protection devices for all electrical automatically operated motors on refrigerators, oil burners and stokers, installed in the City of New York, on and after August 1, 1937. According to Bulletin No. 13, issued by the Department of Water Supply, Gas and Electricity, this protection may be installed as part of the motor assembly, or separately enclosed in a metal cabinet. Mechanical safety combustion or pressure controls, used in connection with oil burners, will not be accepted in lieu of an approved running protection electrical device.

McGRAW JUNIOR BECOMES PRESIDENT

Effective June 21, James H. McGraw, Jr. was elected president of the McGraw-Hill Publishing Co. to succeed Malcolm Muir, resigned. Mr. McGraw, Jr. continues as chairman of the board and assumes the additional responsibilities of the office of president.

Following his graduation from Princeton University in 1915, Mr. McGraw entered the service of the company and for twenty-one years has served actively in various posts connected with its publishing activities. After eight years of service



James H. McGraw, Jr.

with individual papers and groups of papers, he entered the general management of the company as treasurer in 1923, and became executive vice president in 1932. In 1935 he was elected chairman of the board to succeed James H. McGraw, founder of the company.

In 1932 and 1933, Mr. McGraw served as president of the Associated Business Papers and in addition to his work in his own company he has contributed generously of his time and effort to the advancement of business paper publishing. Thoroughly grounded in the editorial tradition, he has applied himself aggressively to keeping the business paper abreast of what is best in modern publishing practice from the viewpoint of both readers and advertisers.

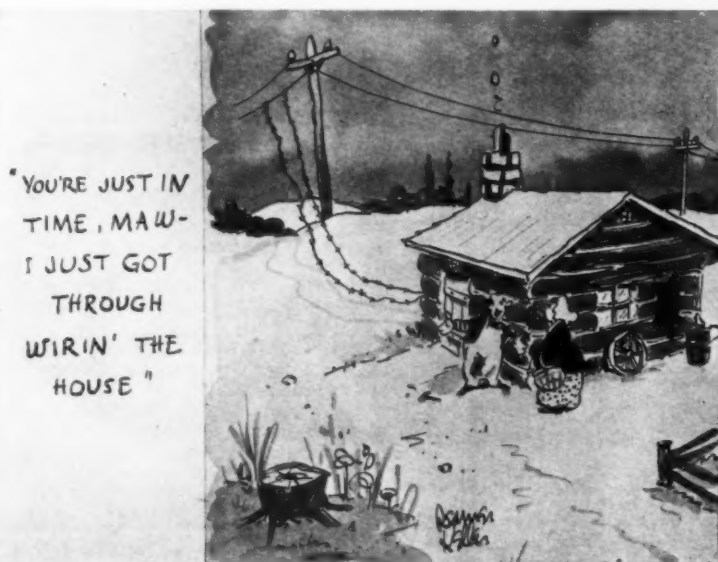
BUILT-IN FIXTURES CONCERN INSPECTORS

The problem of inbuilt lighting fixtures is scheduled for a preliminary skirmish at the convention of both the Northwestern and Southwestern Sections, International Association of Electrical Inspectors, at Salt Lake City in August. It was also up at the first meeting of the Northern California Chapter of the Southwestern Section held at the San Francisco City Hall, June 2. San Francisco and Oakland inspectors found fault not in electrical features, but from the standpoint of heat conduction through the electrical system and resultant damage to the insulation of wires.

PRIZES FOR ELECTRIC HOMES

Citing model electric homes, which have been blooming in scattered areas throughout the country, as straws in the wind, C. E. Wilson, vice president of the General Electric Company, urges electrical service companies to extend their efforts to the entire building industry at once.

This recommendation was made at the annual convention of the recent Edison Electric Institute in Chicago.



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OUTLETS AND FITTINGS

1. A 30-page catalog and price sheet covering single and gauged floor boxes, water-tight nozzles, insulator and conduit supports, clamps and hangers for structural steel members. Also conduit benders and fish wire. Price sheet No. 250. Fullman Manufacturing Co.

LIGHTNING PROTECTIVE EQUIPMENT

2. A 12-page folder on equipment for a.c. rotating machines for protection against traveling-wave voltages due to lightning. Includes installation pictures, diagrams, price lists. Bulletin GEA-1743-B General Electric Company.

CONNECTORS

3. Catalog No. 33C consisting of 48 pages of illustrations, descriptive material and installation pictures of connectors in copper and aluminum for cable, tube, wire, bar and rod. Burndy Engineering Co., Inc.

INSTRULECTOR

4. A slide rule indicator for use in selecting proper instruments for any application, whether central station, industrial plants or transportation industry. Called "Instrulector," it shows what instruments to use, their range, approximate price, size, descriptive literature available. Westinghouse Electric & Manufacturing Co.

MOTORPUMP

5. Catalog describing Cameron motor pumps. Compact machines combining electric motor and centrifugal pumps in a single unit. Ingersoll-Rand Company.

SERVICE CABLES

6. A 20-page booklet with many illustrations and giving facts about service cables and where the various types can be used in conformity with the National Electric Code. Also contains drawings. Anaconda Wire and Cable Company.

TWISTLESS TAPE

7. A folder including samples of various grades of linen finished insulating tape and webbing. Fiber Manufacturing Co.

MERCHANDISING PLAN FOR BRUSH SALES

8. A folder entitled "Profit-Producing Plans" is a catalog, display and packaging set-up for dealers and distributors. Catalog No. 19-D is divided into five sections. One on industrial motors

and generators gives useful information on selection of brushes to meet particular conditions and machines of such types. Ohio Carbon Company.

CONDENSERS

9. New catalog includes listing of all types of condensers and facilitates finding just the kind of condenser best suited for any given application. Aerovox Corporation.

VIBRATION STUDY

10. Folder 5137 on vibration study and other industrial applications of the neobeam oscilloscope. Many illustrations and diagrams included with descriptive material. Sundt Engineering Co.

REGULATORS

11. Bulletin outlining floating-carbon-pile regulators for automatic voltage, current and speed control. Ideal Commutator Dresser Co.

A.C. ELECTRIC PLANTS

12. A folder featuring a.c. electric plants from 300 to 10,000 watts; with remote control and starting battery. Provide constant source of 110-volt, 60-cycle a.c., wherever you live, work or play. Kato Engineering Co.

DISC-BRAKE MOTORS

13. Bulletin 305, describing disc-brake motors for power applications requiring quick, accurate, automatic stops or the holding of a load. Reliance Electric & Engineering Co.

CHECK LIST

14. A check list booklet condensed so it gives department heads or executives a chance to check up the efficiency of their record-keeping equipment or methods. Acme Card System Co.

GENERAL TRANSFORMER

15. A four page bulletin G-3375 suitable for filing purposes. Nine markets for transformers covered, showing uses, with technical data and price information. Dongan Electric Mfg. Co.

LIGHTING FIXTURES

16. A catalog of 49 pages featuring a line of residential lighting fixtures. Herman Perla, Inc.

BLOWOUT COILS

17. Bulletin P-202, describes type BA blowout coils for dc, inductive loads and all other dc, loads higher than dc rating of relay in question. Struthers Dunn, Inc.

SMOOTHARC WELDER

18. Bulletin No. W10, entitled "The Arc-Welding of Tomorrow" presents the advantages gained by the internally stabilized arc. Action photos illustrate the uses of many of the many Smootharc models. Harnischfeger Corporation.

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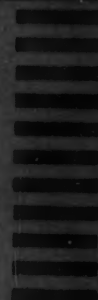
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"BUYERS' GUIDE"

19. Catalog No. 3, consisting of 47 pages of information for Diesel owners, engineers and operators, showing manufacturer's equipment. Diesel Plant Specialties Co.

"FRAHM" TACHOMETERS

20. Bulletin 1465 shows the "Frahm" vibrating reed tachometers for speeds up to 30,000 r.p.m. Suitable for measuring rotational or r.p.m. speeds of motors, turbines, spindles, shafting, vibrations per minute of pneumatic hammers and drills. James G. Biddle Co.

HAZARD LOCATION FAN

21. Bulletin No. 201 describes "31 Series" propeller fans for use in battery rooms, dye houses, chemical plants and other applications where explosive gases and corrosive fumes must be removed. Autovent Fan & Blower Co.

LARGE-AREA SOUND SYSTEMS

22. An illustrated folder describing installation of Western Electric "Bull-Horn" and "Sea Sled" high-powered public address equipment at the Roosevelt Raceway on Long Island. Illustrations include towers, amplifiers and a block schematic diagram. Bulletin WECO-T1374. Graybar Electric Company.

MULTIPLE V-BELTS

23. A 32-page catalog of Gilmer belts including molded rubber multiple V-belts for air conditioning and commercial units of 5 h.p. and over. Detailed information on all types of equipment. L. H. Gilmer Co.

CONTROLLING AND DISTRIBUTING APPARATUS

24. June catalog of 92 pages consisting of illustrations and detailed information on safety switches, meter service switches, service equipment, switch-centers, lighting panels, SafeFuse distributing panels and cabinets, Kbl-Duct fittings, NoFuze circuit breaker material. Bull Dog Electric Products Co.

REMOTE CONTROL EQUIPMENT

25. Bulletin No. 10-C on "Diamond H" remote control switches including detailed construction, wiring and dimension diagrams, illustrations, list

prices, typical installations of different types of switches. Also includes relays, contact switches, steel boxes and cabinets. The Hark Manufacturing Co.

EXPLOSION-PROOF AND DUST-TIGHT UNILETS

26. A 98-page bulletin No. 1004 on explosion-proof and dust-tight unilets, for use in hazardous locations. Includes many new unilets recently added to its line. Appleton Electric Company.

SOLDERLESS CONNECTORS

27. A folder illustrating and describing four connectors to accommodate every type of installation for all wire sizes from No. 8 to 1,000,000 cir. mil. Royal Switchboard Company, Inc.

VAPOR PROOF SPECIFICS

28. Engineering Data sheet No. 5-12A illustrating and describing unit No. 02368-02378 with distribution curves. Holophane Company, Inc.

TRANSFORMERS

29. An 8-page catalog No. 371-M1 describing and illustrating transformers for mercury lamps. Also includes complete specifications for all indoor and weather-proof models and suggestions for mounting of transformers and lamps. Jefferson Electric Co.

TERMINAL BLOCKS

30. Folder describes Type I, Series 1000 of controlled terminal blocks. Provide junction points in any control wiring circuits. Blocks used in wide range of installations, including load dispatching signal system, telephone and telegraph switchboard, talking motion picture equipment, fire and patrol signal systems, elevator control, recording clock systems, junction boxes, meter testing devices, annunciator systems and all modern power switchboards. Burke Electric Co.

COOLERS

31. Bulletin No. HB 537 outlining Kisco "Rated-Capacity" air moving equipment for factory, store, office and home. Kisco Company, Inc.

CONDUIT FITTINGS

32. Bulletin EP-1500 featuring explosion-proof conduit fittings in several types for use in hazardous places.

Includes illustrations, sketches and descriptive material. Killark Electric Manufacturing Co.

SWITCHBOARDS AND PANELBOARDS

33. Catalog No. 37 features illustrations and descriptive material on lighting panelboards, circuit breaker narrow distribution panelboards, circuit breaker convertible distribution panels and dead front feeder panels. All with cabinets. Cleveland Switchboard Company.

WATTHOUR METERS

34. Bulletin GEA-2404A presenting the two-element single-disk watthour meters. Including illustrations, diagrams, installations and descriptive material. General Electric Company.

PULLEYS AND FLEXIBLE COUPLINGS

35. A folder on Congress standardized drives including seven detailed tables on grooved, variable speed, cone, round belt and crown face pulleys and flexible couplings. Congress Tool & Die Company, Inc.

RURAL TRANSFORMERS

36. Catalog No. 106 on rural distribution transformers. Illustrates Type HD and Type RD and also drawings of various features of different designs. R. E. Uptegraft Manufacturing Co.

VOLTAGE REGULATORS

37. Bulletins 5601 and 5602 describe and illustrate electronic automatic alternator voltage regulator Type EF and Type EB. Ward Leonard Electric Co.

CONDUIT BENDERS

38. Bulletin LP-9 outlines conduit benders, turnbuckle pipe and conduit benches, pipe bench, elbow former and joist boring machine. Includes illustrations. Henderson Electric Co.

JUMPER CLAMP

39. A folder featuring the Burndy Redhead, an insulated live line jumper clamp for shunting defective equipment for grounding, and tapping. Burndy Engineering Co., Inc.

NEW IDEAL CATALOG

40. A revised catalog giving complete listing of all products, including new equipment such as washer punch, rotary stripper, turning tool head, air gap gauge, wire stripper, and voltage and speed regulator. Also covers data on electrical and motor maintenance. Ideal Commutator Dresser Co.

"ZIP-LIFT" HOIST

41. Bulletin H-2 entitled "Handling Costs Are on the Spot" features new lightweight "Zip-Lift" hoist as an aid to stopping wasteful production practices with "spot handling." Gives actual production figures in a typical plant. Harnischfeger Corporation.

DURAX CABLE

42. A 12-page booklet entitled "Durax Non-Metallic Sheathed Cable" describing installation and interpreting its use according to rules laid down by the National Electric Code. Anaconda Wire and Cable Co.

WHALE AND VIKING TOOLS

43. Catalog No. 37 listing detailed information on cutters, saw blades and frames, screw drivers, micrometers and knives. Consists of 48 pages. The Forsberg Manufacturing Co.

Electrical Contracting, July, 1937

CIRCLE NUMBERS-SIGN-AND MAIL

ELECTRICAL CONTRACTING

July
(Not good after October 1)

Please send me, without obligation, manufacturers' literature herein described and identified by numbers circled below.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
18 19 20 21 22 23 24 25 26 27 28 29 30 31 32
33 34 35 36 37 38 39 40 41 42 43

NAME..... TITLE.....

COMPANY.....

ADDRESS.....

CITY..... STATE.....

High Lights IN THE NEWS

[FROM PAGE 118]

He proposed an industry program that would seek to broaden the base of electrical service in all homes instead of confining it to isolated "show cases". In the interests of such a program, Mr. Wilson said, the General Electric Company was prepared to contribute contest prizes, both to builders of homes during 1937 and to the interested public, among whom would be found the builders of the future.

The proposed plan involves two types of contests. The first, open to any electrical customer, consists of ten weekly contests. Entrants will be asked to express in their own words the appeal of an electrical way of living. The second contest involves new home builders, whose completed homes may be submitted for judgment under a 10-point electrical standard of living. Radio programs, advertising, and other promotional media will be utilized. Awards contributed by the General Electric Company in the first contest will consist of electrical appliances and "New American" homes. In the second contest, cash awards will be made. Other companies and groups are urged to add to these prizes as desired.

HANS THOLEN DIES

Hans Henry Tholen, of Milwaukee, died on May 28. He was head of the Tholen Electric Company of that city, and Chairman of the Motor Shop Section of the National Electrical Contractors Association and a leader in industry activities in his home town.

Mr. Tholen was born in Port Washington, Wis., in 1882. When he was twenty, he went to Milwaukee and entered the electrical contracting business, working for the Geo. F. Roll Electric Company,



HANS HENRY THOLEN

Electrical Contracting, July 1937

the Smith Electric Company, the Charles Milne Company and the Trester Service Electric Company. In 1923 he started his own company, combining motor repairs and construction.

He has been an active member of the Contractors Dealers Association of Milwaukee and the local electrical league, and of NECA. He was a member of the Tripoli Country Club and a skilled and ardent golfer and bowler. He also enjoyed another hobby, the raising of mallard ducks at his summer home on Pewaukee Lake.

Hans Tholen was well known and loved in the industry, and his sudden death will be a shock to his many friends. He had apparently recovered from a long illness and was himself again, when he suffered a stroke and died within a week.

SAMUEL I. JAGGAR DIES

Samuel I. Jaggar of the electrical contracting firm, Jaggar-Sroufe, Portland, Ore., died of a stroke in a Portland hospital May 28. He established the Morrison Electric Co. in Portland thirty-one years ago. During the war Mr. Jaggar and Harry Sroufe formed the Jaggar-Sroufe firm, and have done many of the largest electrical contracting jobs in Portland and vicinity.

COMING MEETINGS

Minnesota Electrical Council—Summer Meeting, Birchmont Lodge, Bemidji, Minn., July 11-12.

International Association of Electrical Inspectors—Southwestern-Northwestern Sections (Joint Meeting) Salt Lake City, Utah, August 23-25.

Eastern Section, Hartford, Conn., Sept. 20-22.

Western Section, Chicago, Ill., Sept. 20-22.

Southern Section, Atlanta, Ga., Week of October 4.

Illuminating Engineering Society—Annual Convention, Greenbrier Hotel, White Sulphur Springs, W. Va., Sept. 27-30.

National Electrical Contractors Association—Annual convention, Biltmore Hotel, Los Angeles, Calif., October 18-21.

REA LOANS TO BUILD LINES

These further loans to build more power lines, have been reported by the Rural Electrification Administration—

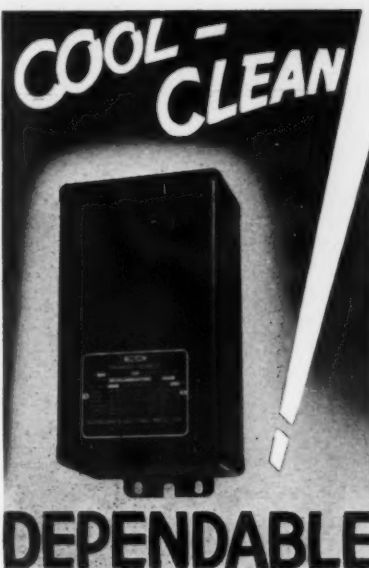
Alabama, Baldwin County—\$200,000 to the Baldwin County Electric Membership Corporation, of Bay Minette, to build 211 miles, to serve 700 customers.

Alabama, Cherokee County—\$235,000 to the Cherokee County Electric Membership Corporation, of Center, to build 228 miles, to serve 996 customers.

Arkansas, Pulaski County—\$190,000 to the First Electric Cooperative Corporation, of Little Rock, to build 211 miles, to serve 678 customers.

Colorado, Morgan County—\$250,000 to the Morgan County Rural Electric Association, of Fort Morgan, to build 248 miles, to serve 644 customers.

Georgia, Taylor County—\$50,000 to the Taylor County Electric Membership Corporation, of Reynolds, to build 51 miles, to serve 175 customers.



With High Intensity Mercury Vapor Lighting accepted by the largest manufacturers in the country, it is time that every factory, mill, foundry, and shop investigate this new and better lighting method.

High Intensity Mercury Vapor light cuts down accident risk—increases working efficiency—cuts the cost of lighting.

DONGAN TRANSFORMERS are built for this purpose by transformer specialists — by the same people that have been building the DONGAN line since 1909.

While it costs you no more to use DONGAN TRANSFORMERS on your installations, it will pay you to install them because they will give you a cooler, cleaner, and more DEPENDABLE installation.

DONGAN ELECTRIC MFG. CO.
2985 Franklin St., Detroit, Mich.

Please send more information on—

- ☐ Mercury Vapor Transformers
☐ General Transformer Line
☐ Supplementary Machine Lighting Transformers

Name

Address

City..... State.....

High Lights IN THE NEWS

[FROM PAGE 121]

Idaho, Nez Perce County—\$400,000 to the Clearwater Valley Light & Power Association, Inc., of Lewiston, to build 300 miles, to serve 900 customers.

Illinois, Iroquois County—\$200,000 to the Eastern Illinois Power Cooperative, of Watseka, to build 185 miles, to serve 585 customers.

Indiana, Hendricks County—\$15,000 to the Hendricks County Rural Electric Membership Corporation, of Clayton, to cover the increased cost of materials.

Indiana, Henry County—\$65,000 to the Henry County Rural Electric Membership Corporation, of New Castle, to build 67 miles, to serve 199 customers.

Maryland, St. Marys County—\$165,000 to the Southern Maryland Tri-County Cooperative Association, Inc., of Welcome, to build 165 miles, to serve 600 customers.

Michigan, Lenawee County—\$250,000 to the Southeast Michigan Rural Electric Corporation, Inc., of Adrian, to build a generating plant and 120 miles, to serve 650 customers.

Michigan, Presque Isle County—\$70,000 to the Presque Isle County Electric Cooperative Association, of Onaway, to build 63.5 miles, to serve 323 customers.

Minnesota, Fillmore County—\$167,000 to the Fillmore County Cooperative Electric Association, of Preston, to build 175 miles, to serve 371 customers.

Mississippi, Leake County—\$115,000 to the Central Electric Power Association, of Carthage, to build 121 miles, to serve 509 customers.

Missouri, Perry County—\$112,000 to the Missouri General Utilities Company, of Rolla, to build 127 miles, to serve 615 customers.

Nebraska, Cass County—\$10,000 to the Eastern Nebraska Public Power District, of Lincoln, to finance wiring and plumbing installations.

New Jersey, Monmouth County—\$113,000 to the Tri-County Rural Electric Company, Inc., of New Brunswick, to build 126 miles, to serve 446 customers.

North Dakota, Benson County—\$60,000 to the Baker Electric Cooperative, Inc., of Baker, to build 51 miles, to serve 265 customers.

Ohio, Fulton County—\$170,000 to the Tri County Rural Electric Cooperative, Inc., of Wauson, to build 170 miles, to serve 750 customers.

Oklahoma, Alfalfa County—\$310,000 to the Alfalfa County Electric Cooperative, of Cherokee, to build 332 miles, to serve 900 customers.

Oregon, Lane County—\$108,000 to the Blachly-Lane County Cooperative Electric Association, of Blachly, to construct a generating plant and 87 miles, to serve 420 customers.

Texas, Deaf Smith County—\$135,000 to the Deaf Smith County Electric Cooperative, Inc., of Hereford, to build 115 miles, to serve 221 customers.

Washington, San Juan County—\$87,000 to the Oreas Power and Light Company, of East Sound, to build a generating plant and 70 miles, to serve 200 customers.

Wyoming, Big Horn County—\$82,000 to the Big Horn Rural Electric Company, of Basin, to build 85 miles, to serve 300 customers.

Wyoming, Lincoln County—\$145,000 to the Lower Valley Power and Light, Inc., of Freedom, to build 90 miles, to serve 618 customers.

Wyoming, Park County—\$50,000 to the Garland Light and Power Company, of Garland, to build 50 miles, to serve 190 customers.

Wyoming, Washakie County—\$50,000 to the Washakie Rural Electric Company, of Worland, to build 50 miles, to serve 154 customers.

MINNESOTA OFFICERS

At the annual state convention held in Rochester, Minn., two sets of officers were elected. For the Minnesota Electrical Council: John Ellenbecker, president; W. S. Johnson, vice-president; F. M. Tripp, treasurer; William A. Ritt, secretary-

manager; and Art Ingebredtson, J. W. Hruska, F. T. Langford, Paul Schorr, D. E. Kehne, E. J. Micka, Sam Newstone, Fred I. Page, F. S. Johnson, Louis H. Gordon, and Ray Mrachek, Board of Directors.

The Minnesota Electrical Association officers are Sam Newstone, Montevideo, president; Ed N. Karst, Fergus Falls, vice-president; William A. Ritt, St. Peter, secretary-treasurer; and Ray Mrachek, Rochester; Leo P. Kemp, Winona; C. W. Turner, Faribault; E. J. Micka, Hibbing; John Ellenbecker, St. Cloud; W. S. Johnson, Duluth; Louis H. Gordon, Albert Lea; J. W. Hruska, Mankato; E. M. Raetz, Rochester; executive committeemen.

More GOSSIP

Political Strategy

Some cities enjoy good legislation covering electrical inspection and licensing, while others do not. Vernon M. Miller of the Miller-Liskey Electric Co., Hagerstown, Md., cites his city as a bad example. Only the plumber has an ordinance perhaps because the mayor is a plumber. So now that Mr. Miller has been elected to the city council, Hagerstown is probably in for some much-needed law and order.



LOBSTER AND TURKEY—When this group of electrical inspectors answered shore-dinner call at Savin Rock overlooking Long Island Sound, the landlubbers chose lobster and the shore-town boys turkey. This June 9 meeting of the New England Chapter, IAEE, was well attended by members and manufacturers. It was the first inspector group to hear Richard G. Slater outline the makeup and purposes of the Industry Handbook of Interior Wiring Design.

Cooperative Selling

To do business with the saw mills and veneer industries located around Macon, Ga., A. C. Eves of the Eves Electric Co. became familiar with engines and generators as the first step. Having helped several operators in securing their prime moving equipment, the general wiring jobs followed as a part of the transaction.

Success Term

Doing something for somebody when they want it done is called being "Service Wise" by C. F. Crowder of the H. N. Crowder Jr. Co., of Allentown, Pa. To back it up, this company has its employees so well organized that 50 of its men could be spotted in one hour for night-time emergencies.

Rent Decorative Lighting

It pays to carry a large stock of temporary and decorative lighting equipment in town, says the Engler Electric Company of Utica, N. Y. Over 10,000 stringer sockets, three dozen 500 watt floodlights, together with color screens and other accessories represent a large investment. But this contractor finds the biggest profits in rental. Leaving decorative lighting materials in the hands of the customer encourages amateur installations, according to Mr. Engler. For this reason he not only discourages the outright sale of this type of equipment, but occasionally buys up similar material that appears in the locality.

Evil Words

The industry has prattled so aimlessly in stereotype terms without success, that the Essex Electrical League of Newark, N. J., proposes to do something about it. Three words are to be eliminated from the everyday vocabulary of its members. They will no longer use the words "Adequacy", "Saturation", or "Hazardous". Instead these sales-minded Leaguers will speak of "Comfort", "Unlimited Uses", and "Safety to life and property". Hear! Hear!

Gets Hawaiian Job

H. H. Walker, versatile Los Angeles contractor, takes on everything from transmission lines and huge pumping plants to colleges, factories and even big movie star homes. He has just been awarded the contract for an \$191,000 electrical distribution system for Hickam Field, the new army air field at Honolulu. H. H. Walker, Inc., has done work in the Islands before, as well as throughout the west.

Costly Hazards

An example of the extra costs involved when doing work for hazardous industries, comes in from O. Sweningson, whose company specializes in risky jobs around Chicago's industrial belt. Working in the Paris green processing area of a paint and varnish plant, meant 8 hours pay for 4 hours of work, as well as furnishing work clothing, and providing gas masks for the crew. Too often a hungry competitor fails to consider this extra cost, or allow for the curtailed production efficiency of men working in short spurts in rooms where normal breathing is restricted.

SECURITY

For Contractors!

For neat, quick, permanent jobs devoid of trouble, Security lives up to all the promise of its name. And there is security for the contractor against kick-backs, against failures, against complaint. To be sure a good job is done for good, use Security Friction Tape.



NON-RAVELLING
STRAIGHT-TEARING
HIGHLY INSULATING
HIGH TENSILE STRENGTH
STRONG ADHESION

United States Rubber Company

United States Rubber Products, Inc., New York, N. Y.



News of NECA

ACTIONS TAKEN BY EXECUTIVE COMMITTEE

In the three days meeting of the Executive Committee at Hotel LaSalle, Chicago, June 7th to 9th, consideration was given to many important matters and the following actions taken to establish Association policies.

Changes in Basis of NECA Dues

There are active organizations embracing all types of retail electrical merchandising business. There is a national association designed to serve the special interests of motor repair shops. The broader scope in those specialized groups makes it highly desirable that all members of NECA operating retail merchandising stores or motor repair shops should also affiliate with these organizations. The following resolutions were therefore, adopted by NECA Executive Committee in order that there should be no duplication of dues.

1. Retail Electrical Merchandising.

RESOLVED, That the inclusion of the sale of household appliances by our members who are operating a retail merchandising business be eliminated from their gross volume of business in reporting their classification for the payment of NECA dues.

2. Motor Repair Shops.

RESOLVED, That the inclusion of motor repairs and motor rewinding by our members be eliminated from their gross volume of business in reporting their classification for payment of NECA dues.

Outside Chapter Jurisdiction

In many instances local NECA Chapters assume the payment of NECA dues for all members of their chapter, such payments are made out of the funds collected by them for local dues based upon the gross volume of their members business done within the Chapter jurisdiction. Some of these chapter members may do a very substantial part of their business outside of the chapter jurisdiction, however, and so the Executive Committee

adopted the following resolution applying to them:

RESOLVED, That each NECA member shall pay dues based upon the total volume of his electrical contracting business in the United States and Canada, and whatever portion of such dues is paid through one or more NECA Chapters, shall be credited to his dues account and the balance shall be remitted by him directly to the NECA Headquarters Office in New York.

The following amendment has been made to the NECA By-Laws, Article II, Section 1:

The annual dues of members shall be not less than \$15.00 and not more than \$500.00, and shall be paid in advance in accordance with the classification schedule, based upon the total amount of



TOLEDO CHEER:—There are 32 contractors in the Toledo Electrical Contractors Association, of which H. C. Scannell (center) is president, and Clarence F. Hammer (right) is secretary. This photo taken at the Scannell Electric Co. office would not have been complete without including the younger set. So R. C. Scannell joined dad in this contest of smiles. Mr. Hammer is secretary of the Ohio Electrical Contractors Association and also a district chairman of the Ohio Construction Council. His district takes in seventeen counties and serves 250 employer members comprising various building crafts.

gross sales billed in the members' electrical contracting business in the United States and Canada, in the twelve months' period preceding the month in which his application for membership is submitted, or preceding the first of the month following the expiration of his previous year's dues.

Apprentice Training

A very constructive interim report was submitted by J. W. Collins, Chairman of the Committee on Apprentice Training, on it the following significant summary is made of the present situation as disclosed by the Committee's:

"We are not so short of men as we are of man-power. Practically no one has entered this trade for the past ten years as an apprentice or a mechanic, and therefore our man-power is reduced by a matter of ten years of age added to each of our men, which brings us an average age of those engaged in the business to something approximating fifty years. This is entirely too much of a load for this industry to carry, inasmuch as it raises our labor units approximately 15%."

The following resolution was, therefore, adopted by the NECA Executive Committee:

WHEREAS, There is developing in our industry a serious situation resulting from the breakdown of apprentice training during the past ten years, with consequent increase in the average age of our skilled workmen,

THEREFORE, BE IT RESOLVED, That the National Electrical Contractors Association undertake a study of existing apprentice training plans looking towards development of a uniform national apprentice training program for the electrical contracting industry, and

BE IT FURTHER RESOLVED, That the members of NECA in every locality undertake local studies of this problem and cooperate with the National Association in its solution.

Testimonial to George W. Patterson

A unanimous vote of appreciation and thanks was extended to George W. Patterson, Chairman of the NECA Cost Data Committee for his splendid services in the production of the NECA Manual of Labor Units and the continuing monthly service of new data sheets, which has made the Manual of Labor Units the most valuable estimating guide available to electrical contractors.

National Adequate Wiring Bureau

The appointments of NECA's two representatives on the National Adequate Wiring Bureau were confirmed by the Executive Committee as follows:

S. J. O'Brien, New York City.
Ed. G. May, Albany, N. Y.

Electrical Contracting, July 1937



SERVICE Entrance and Drop Cables made by the American Steel & Wire Company have been designed to reduce the cost of service change-overs involved in the installation of ranges and other appliances in homes, and to eliminate current diversion.

Our "Tamperproof" types have a concentric bare neutral conductor

applied over the insulated conductors which makes it difficult to divert current without causing a short circuit between the inner and outer conductors when the cable is cut. The "Tamperproof" types (SD and SE) are approved by Underwriters for circuits not exceeding 150 volts to ground.

Type ASE is designed primarily for

use under conditions where the Code calls for an entrance cable of the "protected" type. Type USE, for underground entrances, can be buried direct in earth without ducts or other external protection. Type ASE is also approved for this same purpose.

For full information on our Service Entrance and Drop Cables write for Bulletins No. 102 and 104.

SERVICE ENTRANCE *and* DROP CABLES

AMERICAN STEEL & WIRE COMPANY

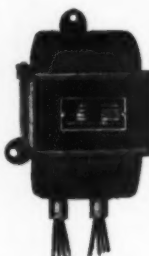
Cleveland, Chicago and New York



Columbia Steel Company, San Francisco, Pacific Coast Distributors • United States Steel Products Company, New York, Export Distributors

UNITED STATES STEEL

SORGEI **AIR-COOLED** **TRANSFORMERS**



A size and type for every purpose; single phase, 2 and 3 phase. Standard stock sizes $\frac{1}{4}$ to 50 Kv-a. Other sizes to order.

SAVE MONEY

Sorgel air-cooled transformers are easy and economical to install, anywhere inside of buildings, without fireproof vault or enclosure. No oil—no upkeep. Approved by Underwriters. Economical and dependable in operation—Ideal for obtaining 110 volts for lighting, portable tools, etc., from 220, 440 or 550 volt, A.C. power—for phase changing—for voltage boosting or adjusting.

Write for literature with diagrams and prices

SORGEI ELECTRIC CO.

No. Plankinton Ave., Milwaukee, Wis.

MINERALLAC HANGER



Conduit $\frac{3}{8}$ "— $2\frac{1}{2}$ "
Cable to $2\frac{1}{8}$ " (with Bushings)

MINERALLAC JIFFY CLIP



Sizes from .250" O.D. Tubing to $1\frac{1}{4}$ " conduit.

See your Jobber

New York City Office
Theodore B. Dally
50 Church Street

MINERALLAC ELECTRIC CO.
25 N. Peoria St., CHICAGO

News of **NECA**

[FROM PAGE 124]

Death of Hans H. Tholen

The following resolution was adopted by the Executive Committee:

WHEREAS, It is with profound sorrow that the Executive Committee of National Electrical Contractors Association have learned of the death, on May 28th, 1937, of Hans H. Tholen, of Milwaukee, respected and beloved member of our Association, and Chairman of the National Motor Section, and

WHEREAS, Hans H. Tholen, president of Tholen Electric Company of Milwaukee, has been a member of the National Association since July 1, 1929, and has been an active and loyal worker in the organization, and

WHEREAS, The members of the Executive Committee feel a deep personal loss in the passing of their friend and associate, whose fine character and excellent judgment contributed much to the deliberations of this body,

THEREFORE, BE IT RESOLVED, That we go on record in expression of our tribute to the memory of Hans H. Tholen, and that the Secretary be instructed to spread this Resolution on the minutes of the Association, and to send a copy of it to Mr. Tholen's family.

NECA CONVENTION TOUR

Nearly 100 reservations have been received for the 20-day NECA Convention Tour to Los Angeles, starting from Chicago on October 12th and returning on October 31st. The tour is open to all electrical contractors and their friends, including members of other branches of the industry who desire to participate in the Los Angeles Convention. Full information may be obtained from NECA headquarters. Reservations should be in the hands of the NECA Convention Tour Committee by July 15th to permit of arrangement for train equipment.

LOS ANGELES CONVENTION

Announcement has been made of an "Electrical Exposition Extraordinary," sponsored by the Los Angeles Electrical

Contractors Association, to be held in the Biltmore Hotel, Los Angeles, on October 18th to 21st inclusive in connection with the 35th Annual Convention of National Electrical Contractors Association. The Exposition will be held in the beautiful ballroom and foyer of the Biltmore Hotel adjacent to the convention hall and will provide space for more than 100 exhibits of the latest developments of manufacturers' products in the electrical field.

NEW NECA CHAPTERS

During the past month, three new Chapters of National Electrical Contractors Association have been chartered, as follows, Topeka, Kansas, Chapter, J. R. Woodhull, Pres., C. R. Shrake, Secy.; Dallas, Texas, Chapter, H. A. Brewster, Pres., R. Fischl, Secy.; Omaha, Nebraska, Chapter, C. O. Heath, Pres.

Material for this department is supplied by the headquarters staff of the National Electrical Contractors Association, 420 Lexington Avenue, New York.

**Better Quality
Wiring Jobs at
Less Cost**

IDEAL WIRE CONNECTORS

SOLDERLESS • TAPELESS

Step up the quality of your wiring jobs—produce work that passes inspection quickly and easily—and reduce your wiring material cost with Ideal Wire Connectors.

Has greater conductivity than a solder and tape joint, greater than the wires it joins.

No solder, tape or heat—simply thread on and joint is made.

Fully Approved. Listed by Underwriters' Laboratories.

Ideal Commutator Dresser Co.
1041 Park Ave. Sycamore, Ill.





*The critical standards
of one of the nation's leading
research organizations are
reflected in the installation of...*

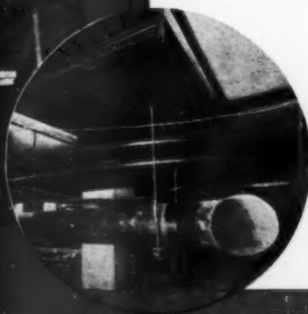
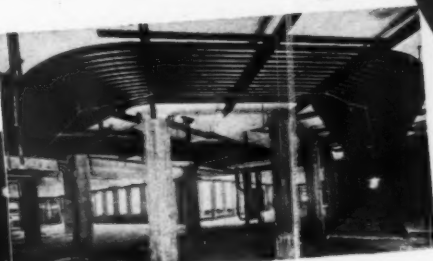
CENTRAL rigid steel CONDUIT

THE MELLON INSTITUTE OF INDUSTRIAL RESEARCH IN PITTSBURGH

is one of a large number of prominent buildings throughout the country equipped with "Central" Rigid Steel Conduit.

Within the walls of this classic example of modern architecture, a large part of the vital and intricate electric wiring system is protected for all time by the use of Central Rigid Steel conduit—most enduring conduit known . . . manufactured especially for the most severe service conditions . . . the only type of wiring system approved by the National Electric Code for hazardous locations.

Possessing an ideal combination of balanced wall thickness and weight as well as correct tensile strength, "Central" Rigid Conduit withstands vibration better than lighter tubing. It is readily adaptable to every type of construction including the most severe bending and shaping requirements . . . excellent reasons why IT ALWAYS PAYS TO SPECIFY "CENTRAL" FOR QUALITY CONDUIT.



CENTRAL TUBE CO.

PITTSBURGH, PA.

With the MANUFACTURERS

Whitfield Joins Appleton

Murray J. Whitfield for some time manager of conduit sales for Steel and Tubes, Inc., subsidiary of Republic Steel Company in Cleveland, has resigned to become general sales manager for Appleton Electric Company in Chicago. On graduating from the University of Wisconsin, Mr. Whitfield started in business with the Economy Fuse and Mfg. Company, first in accounting and then in sales. A few years later he went with the Jefferson Electric Company. He joined Steel and Tubes in 1929 and organized a sales division to introduce electrical metallic tubing.

Steel & Tubes Changes

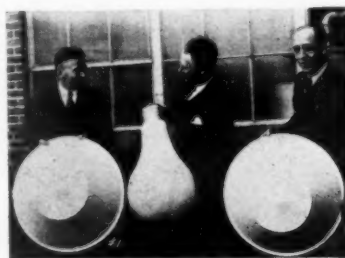
George W. Butler succeeds Mr. Whitfield as manager of conduit sales. He was formerly assistant midwest sales manager in Chicago. Henry Coward has been transferred from the Kansas City office of Steel and Tubes to succeed Mr. Butler, while Howard H. Leving moves from Dallas to Kansas City.

Triangle Conduit & Cable Company of Brooklyn, N. Y. recently opened its new general office building at Horace Harding and Queens Blvd., Queens Borough, New York. The new two-story, brick structure will house the administrative, sales, purchasing, treasury and audit departments.

J. Y. Dahlstrand has been appointed special representative, to handle the sale of automatic alternator voltage regulators for Ward Leonard Electric Co. He will be located at 1719 South Street, Burlington, Iowa.

Graybar Electric Company announces the opening of three new branches. One is in Peoria, Ill. at 212 East State Street. V. A. Elmblad was appointed manager, with W. R. Harting as service supervisor. Another at Harrison and East Front St.,

Butte, Mont., with E. J. Riley as manager and C. M. Lawrence as service supervisor. The third is the Queensboro branch at Elmhurst, Long Island.



PLASTIC REFLECTOR—A. F. Wakefield, President, F. W. Wakefield Brass Co., C. W. Hodgson, Manager, Lake Erie Power & Light Co. and C. A. Schroeder, Secretary of Wakefield Co. pose here with the largest plastic molding ever made. A pressure equivalent to the weight of 20,000 men is applied to produce this $5\frac{1}{2}$ pound reflector, which replaces a glass reflector of similar dimensions weighing 26 pounds.

Ideal Commutator Dresser Co., of Sycamore, Ill., has moved its New York Office to larger quarters at 61 East 11th Street.



LIGHTING PIONEER—George H. Stickney, of the General Electric Company, received a testimonial at a recent dinner in his honor at Nela Park, Cleveland, in recognition of his numerous contributions to lighting progress during his more than forty years of continuous service with this company.

Webster Joins Lord and Thomas

Forrest Webster, manager of merchandise sales for Cutler Hammer, Inc., in Milwaukee, resigned to join the Lord and Thomas advertising agency in New York. Mr. Webster started work with the H. W. Caldwell Company, now part of Link-Belt Company, and advanced from office boy to advertising manager. He went to Standard Oil Company of Indiana and then to the Irvin F. Paschall Agency in Chicago, and joined Cutler Hammer in 1925 as advertising manager.

Mr. Webster has been president of the National Industrial Advertisers Association and of the Milwaukee Association of Industrial Advertisers. He now heads the advertising and publicity committee and the enclosed switch section and serves on the business development committee of the National Electrical Manufacturers Assn.

Ajax Flexible Coupling Co. of Westfield, N. Y. announces the addition of three sales offices in Akron, Kansas City and Seattle. Beese & Terry will represent Ajax in Akron, Arthur D. Schwartz will cover Kansas City territory and W. F. Nichols serves the Seattle area.

Syntron Company, formerly of Pittsburgh, Pa., moved into its new factory at Homer City, Pa. on June 11.

United States Rubber Products, Inc., Mechanical Goods Division, New York has announced that C. W. Gilmer, manager mechanical sales, Seattle Branch has been transferred to the New York office, as belting sales engineer. L. F. Koepp, formerly salesman in the Seattle District, has been appointed manager mechanical sales to succeed Mr. Gilmer. Dr. Earl G. Sturdevant has been appointed consulting engineer of the Electrical Wire and Cable Department.

Westinghouse Electric & Manufacturing Company has appointed S. D. Mahan general advertising manager. Roger Bolin has been made merchandising advertising manager, to succeed Mr. Mahan. Their headquarters will be in Mansfield, Ohio.

Switchgear Exhibit

A traveling exhibit of recently developed switchgear equipment, sponsored by General Electric Co., is on an extensive tour of the East and Middle West. The exhibit is designed to demonstrate the practical advantages of modern circuit-interrupting apparatus. This equipment will be set up in hotels or utility auditoriums, in a number of key cities, and shown to industrial and electrical groups.

Particular emphasis is placed on the oil blast principle of circuit interruption, in oil circuit breaker construction, and on silver contacts and arc quenching devices in air circuit breaker design. Working models and charts are used to demonstrate the principles discussed.

Lincoln Electric Company, Cleveland has appointed William Sivy and B. B. Ross to the sales staff of its Philadelphia Office, 401 North Broad St.

Clare T. Smallcomb has been made California ventilating equipment distributor for the De Bothezat Division of the American Machinery & Metals Manufacturing Company, New York.

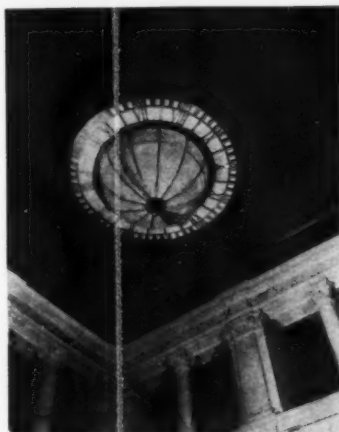
National Electrical Manufacturers Association has recently issued two new publications. One presents also Household Electric Refrigerator Standards, Publication No. 37-41, selling for 40 cents. The other one covers Indicating Electrical Measuring Instruments and Instrument Transformer Standards, Publication No. 37-42. It sells for 60 cents. Copies may be obtained from the Association headquarters, 155 East 44th Street, New York City.

John W. White has been elected vice-president and general manager of the Westinghouse Electric International Company. He will make his headquarters in New York City.

In a news item last month, we reported that Sangamo Electric Company of Springfield, Ill. had opened a new office in Chicago, which gave the impression that there had been no previous office there. It was a change of address.

The Mercoid Corporation, of Chicago, has appointed R. M. Keatts, J. F. McCauley, William Ufer and Walter Lischett to its Sales Department. The last two named will be in the Chicago office, Mr. Keatts will work out of the Cincinnati office and Mr. McCauley will cover the Cleveland area.

Cutler-Hammer, Inc. of Milwaukee, Wis. have recently opened a new office in Youngstown, Ohio. E. J. Gove will be in charge of this office, located at 1106 Central Tower, also a new sales office in Dallas, Texas. It is located at 624 Santa Fe Building.



TERRESTRIAL GLOBE—Clock hanging in the foyer of the Christian Science Monitor Building, in Boston. It contains 46 Telechron clocks. Hixon Electric Co. was the electrical contractor.

Gar Wood Industries, Inc., of Detroit, Mich., has enlarged its air conditioning division sales staff. R. J. Owen, Joseph F. Pope and Arthur C. Bader have been made branch salesmen.

Classified Advertising

Wanted by electrical contractor in middle west city, an estimator and engineer with technical education and experience. Give full information in first letter. Box 71, Electrical Contracting, 330 West 42d St., New York City.

Position Wanted: Electrical estimator and engineer desires a position with a contracting firm. Twelve years experience with New York and New Jersey electrical contractors. Technical graduate, registered engineer, specialist in large public and industrial installations. Competent to estimate, engineer, organize and supervise electrical installations. Reasonable salary—details upon request. Address Box 72, Electrical Contracting, 330 West 42d St., New York City.

Be Wise

Investigate

**ENAMELKOTE
GALVAKOTE
ELECTRICTUBE
HOTKOTE**

WE invite your most critical inspection of these finer brands of Conduit. You will save time and money on the job because of the easy working qualities. For full details see our full page ad in the Buyer's Reference number of Electrical Contracting. Samples and descriptive literature will be gladly sent on request.

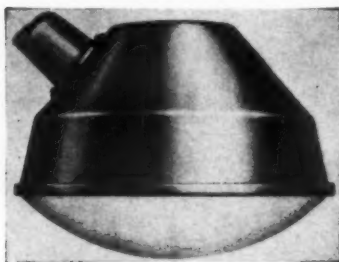
**CLAYTON MARK
& CO.**

OPERA BUILDING
CHICAGO, ILL.

Equipment NEWS

Angle Reflector

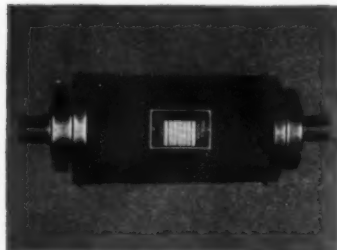
A 400-watt balanced symmetrical angle reflector for mercury vapor lighting, where intensive local lighting of vertical or horizontal surfaces from the side is required. Particularly adaptable to lighting spray booths, assembly lines, conveyors, inspection frames and similar applications. Supplied with two types of dust covers, snap on and hinged. Both dust tight between glass and reflector. Hinged type allows bottom of cover to swing open. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.



WESTINGHOUSE ANGLE REFLECTOR

Lamp Transformer

Mercury vapor lamp transformer designed in form of cylindrical case that can be suspended from ceiling between lamp and conduit. Also equipped with special bracket for wall mounting, to facilitate installation and handling. Other types of mercury vapor lamp transformers include outlet box types for wall mounting and weather-proof enclosed types. Sola Electric Company, 2525 Clybourne Ave., Chicago, Ill.



SOLA ELECTRIC TRANSFORMER



VENT-O-LITE CORP. UNIT

Illuminates and Ventilates

"Vent-O-Lite", a combination ceiling lighting fixture and exhaust fan that both illuminates and ventilates the room. Looks like a lighting fixture but fan housing and ducts are buried in ceiling between beams. Smoke and odors are drawn through fixture louvers by fan and forced outside building through a duct 8-in. wide by 6-in. high. Available in two sizes; Type C: 11-in. by 11-in. for installation in center of room. Type W: 10-in. by 12-in. for over sink, range or between kitchen cabinets. Additional wall switch controls fan independent of light. May be used also in card rooms, play rooms, finished basements. Vent-O-Lite Corp., Jamaica, N. Y.



TRENT VANE STRIP HEATER

Vane Strip Heater

Heater used to promote convection of free air, without compression or blast, to heat air stream or blast and to heat liquids. Type Lev. has one terminal at each end and Type LV, two terminals at one end. Each vane solidly welded in position. Dimensions and spacing of vanes depend upon application and space available. For high voltage circuits, refractory insulating bushings are supplied. Harold E. Trent Co., Philadelphia, Pa.



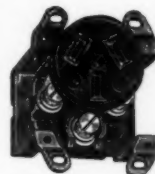
INDICATOR CORP. RENEWABLE FUSE

Indicating Renewable Fuse

A renewable fuse with permanently attached neon light indicator and pulling handle. Handle and encased light rigidly attached for severe service. Neon light gives clear visual indication when fuse link is blown. Made in all sizes for 250- and 600-volt circuits. Indicator Corporation, Newark, N. J.

Flush Range Outlet

Connections are easy in this flush range outlet, now available with one screw solderless connectors. Designed for straight-in-wiring. No awkward bends of heavy wire. Takes standard 4-in. or 4½-in. box with standard switch cover. Made of black Bakelite. Arrow-Hart & Hegeman Electric Co., Hartford, Conn.



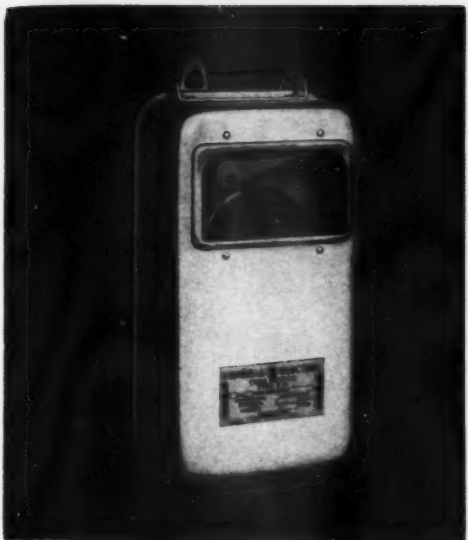
ARROW-HART &
HEGEMAN
RANGE
OUTLET

Hazardous-Area Fan

For industrial applications such as battery rooms, dye houses, or chemical plants, where explosive gases and chemical fumes must be removed, spark proof fans must be used. The Autovent "31 Series" vapor-explosion proof propeller fan is made with copper or brass fan wheels or other non-ferrous metals. Motors bear Class I, Group D ratings, and have acid-moisture proof windings that are impregnated with bakelite coatings. Autovent Fan & Blower Co., 1805 N. Kostner Ave., Chicago, Ill.



AUTOVENT EXPLOSION-PROOF FAN



3 SIGNS

OF A PROFITABLE TIME SWITCH FOR CONTRACTORS

READY
ACCEPTANCE

EASY
INSTALLATION

LOW
MAINTENANCE

Ready Acceptance

For a readier acceptance of your window-wiring bid, specify G-E time switches as control. The G-E monogram on millions of MAZDA lamps, on motors, refrigerators, ranges, and a thousand other G-E products, has made "General Electric" a name familiar in industry and the home. In your prospect's mind it stands as the symbol of reliability and accuracy.

The dependable Telechron clock motor, which is used in popular high-quality timepieces, makes your selling job easier. It is assurance to the prospect of the fine reliability of the G-E time switch.

Easy Installation

Your costs are less because G-E time switches are easy to install. Liberal spacing below the terminal block, five convenient knockouts for conduit connection, and connecting lugs simplify the wiring job and save workmen's time.

Low Maintenance

G-E time switches are always dependable. The extra-heavy silver contacts, reliable Telechron motor, and sturdy design insure customer satisfaction that will bring other installations and repeat orders for you. Specify G-E time switches and eliminate expensive profit-consuming service calls. You can wire one of these switches and forget it.

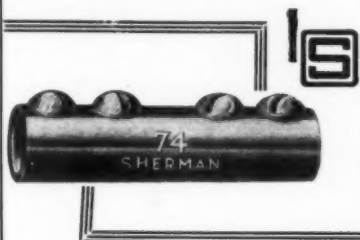
Be sure to write for your copy of Bulletin GEA-1427F on these general-purpose time switches. Address your request to the nearest office of General Electric Supply Corporation, Graybar Electric Company, or General Electric Company, Dept. 6C-201, Schenectady, N. Y.

GENERAL  **ELECTRIC**

440-81

SHERMAN SET SCREW CONNECTORS

A COMPLETE LINE



★Made in 14 sizes for stranded or solid wire. Dimensions and proportions held to accurate size. Made of solid brass by the well-known Sherman Precision Method.

Send for Bulletin No. 8.

H. B. SHERMAN MFG. CO.
Battle Creek, Mich.

Built-in kitchen VENT FAN



AUTOMATIC . . .
EASY TO INSTALL . . .
ADJUSTABLE to wall
thickness . . . no
wood nor metal frame
necessary . . . no
screws in plaster,
wood or brick needed
to install.

The 10-inch quiet type fan removes cooking odors, steam, smoke and excessive heat quickly and quietly—a vent fan in demand. Available for A. C. or D. C. current; A. C. type is non-radio interfering. Automatic switch and shutters are controlled by opening and closing of the door. Opening the door starts the motor and opens the shutters. Closing the door stops the motor and closes the shutters. Attractive finish—inside and outside frames are polished cast aluminum, adjustable for wall thickness 7" to 13"—special for walls 12" to 24" at small additional cost. We'll gladly send you complete information upon request.

SIGNAL ELECTRIC MFG. CO.
Menominee, Michigan
Offices in all principal cities

SIGNAL

Equipment NEWS

[FROM PAGE 130]

Fire Alarm Actuator

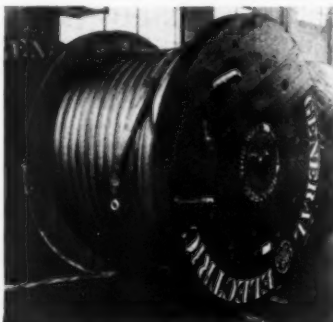
This device is wholly contained in a vacuum tube which permanently protects mechanism against dust, air, and possibility of tampering. Sensitivity and accurate calibration claimed for long periods of time. Approved for a fifteen-foot spacing, both open and closed circuits up to 250 volts. Rating for open circuit is 135 degrees F., 185 degrees F., or 260 degrees F., 110 volts, 0.5 ampere; and closed circuit is 135 degrees F., 110 volts, 0.5 ampere. Other vacuum tube fire detectors are supplied for operating temperatures ranging from 0 to 300 degrees F. Thomas A. Edison, Inc., Orange, N. J.



EDISON FIRE DETECTOR

Cable Pulling Eye

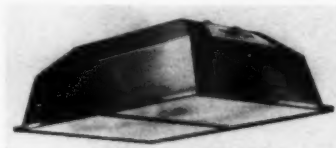
Heavy lead sheathed multi-conductor cables may be ordered in exact lengths, made up with pulling eyes to facilitate installation. These eyes are first attached to the stranded conductors for mechanical strength, then the lead sheath is effectively sealed to the eye by means of a wiped joint. Eyes are returnable for credit after a cable length has been installed. Illustrated is a reeled length of 3-conductor, 500,000 c.m. cable showing the eye and the opposite stub-end of cable, all sealed to exclude moisture. General Electric Co., Schenectady, N. Y.



GENERAL ELECTRIC CABLE PULLING EYE

Panelite

New Wheeler panelite provides a large arc, low brightness light source. Designed for composing room tables, typesetting, tailors' cutting tables, inspection work and applications involving close work on shiny surfaced materials. Cast aluminum hinged doors permit easy access to lamps. Opal glass diffuses light. Four sockets permit use of lamps ranging from 25 to 100 watts. Wheeler Reflector Co., Inc., 275 Congress St., Boston, Mass.



WHEELER PANELITE

Signal Horn

Type 30 horn with a directional projector. May be rotated through an angle of 180 degrees. Water-tight and exposed parts non-corrosive. Aluminum housing tapped on both sides for 1-in. conduit, so one or both wire entrances may be used. A.C. only 6 to 250 volts. Federal Electric Co., Chicago, Ill.



FEDERAL ELECTRIC TYPE 30 HORN

WESTINGHOUSE
ENTRANCE CAP



Service Entrance Cap

Loose coupled grip shoes at the point of pressure on the clamping screw of this service entrance cable cap, permits grip to conform to irregularities in the cable covering, assuring a tight clamp with locking effect. Grip shoe turns freely on the set screw which is upset to retain shoe. The broad clamping surface prevents injury to the table covering. Westinghouse Electric Supply Co., New York City.

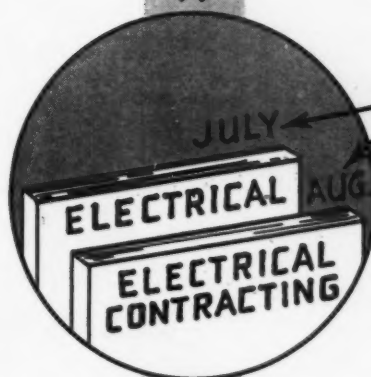
Electrical Contracting, July 1937

SUMMER TIME IS BUILDING TIME

SUMMER MONTHS • 1935

SUMMER MONTHS • 1936

37



**TWO
IMPORTANT
ISSUES**

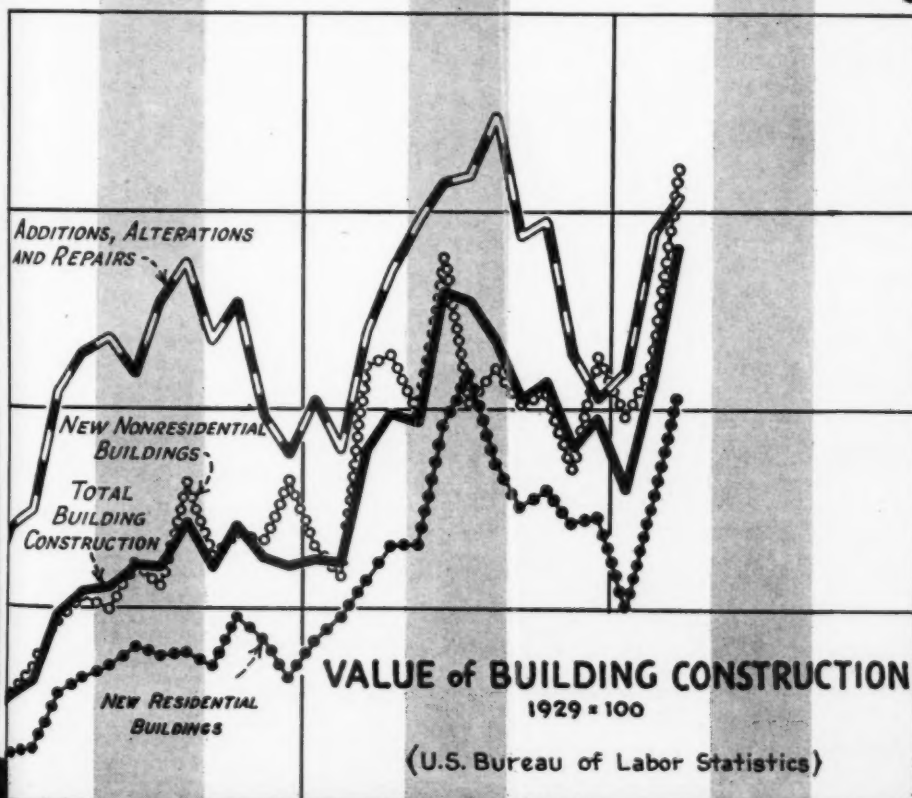
that will

**BUILD
BUSINESS
FOR YOU**

during the

**SUMMER
CONSTRUCTION
PEAK**

80



MR. MANUFACTURER:

When you go on your vacation, make sure that your sales promotion doesn't take a vacation, too. For this is the time of year when such promotion is especially needed to get a slice of that summer building peak shown on the attached chart.

The August issue of **ELECTRICAL CONTRACTING** will be read by the men engaged in electrical construction at a time when they are busiest, and large orders are being placed.

Reserve your space now for this important issue. Closing date, July 20th.

ELECTRICAL CONTRACTING
A McGraw-Hill Publication
330 West 42nd St., New York City

BUILDING TIME IS BUYING TIME

K&H

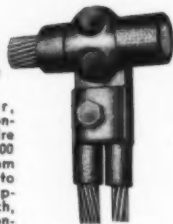
Solderless Terminal

LUGS

and connections

**Perfect
for the job
you want done**

This two-conductor, single branch, Tap Connector will take run wire sizes from 1/0 to 500,000 C.M. Tap wire sizes from No. 4 to No. 8—3/0 to No. 5. Can also be supplied in double branch, turn or multiple conductors.



CAT. No. 1515

• A connector for any job
WRITE FOR COMPLETE CATALOG

• A live wire is
no better than its connections.

KRUEGER & HUDEPOHL

232-8 Vine Street, Cincinnati, Ohio

Dealer NEWS

Do you have calls for the equipment listed below? The modern design and quality construction of Columbia products have made them leaders in their fields and our dealer proposition is attractive. Check the items in which you may be interested and we will send you complete information regarding them.

Plating Generators	
A. C. Generators	
Plating Tank Rheostats	
Tong Test Ammeters	
Synchronous Motors	
Motor Generator Sets	

COLUMBIA

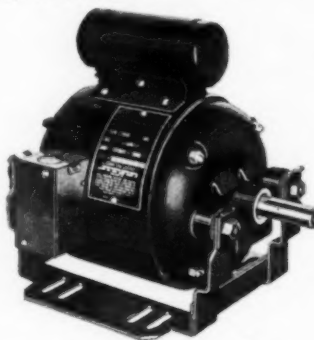
COLUMBIA ELECTRIC MFG. COMPANY
4519 HAMILTON AVENUE
CLEVELAND, OHIO

Equipment NEWS

[FROM PAGE 132]

Capacitor Motor

Two speed, capacitor start induction run, resilient-mounted motor, furnished in ratings from one-sixth to one-half horsepower. Speed changes obtained by three-point switch or automatic control, providing speed control for belted blowers, fans and similar installations. High speed is 1,750 r.p.m.; low speed 1,150 or 850 r.p.m. Wound for long hour service, with low starting current consumption and normal starting torque. Peerless Electric Company, Warren, Ohio.



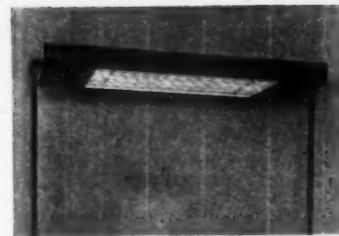
PEERLESS ELECTRIC MOTOR

Magnetometer

An instrument to indicate the polarity of a magnetic field. A positive field causes the needle to deflect to one side, a negative field to opposite side. Negative posts of three dry cells are connected together and to star connection of a three phase induction motor. Other leads are taken from each positive post to each motor lead. The stem of the magnetometer is placed in close proximity to the inside of the stator core. A correctly connected winding will show same amount of deflection but in a reverse direction for each pole as the magnetometer is moved around inside the stator core. Recommended to check motor connections by the polarity test, to test for shorted coils and to check opens, shorts and reversals in armatures, both a.c. and d.c. Available in horizontal and vertical styles. R. E. S. Swam & Co., Hanover, Pa.



SWAM MAGNETOMETER



BARKON-FRINK DAYLIGHT LAMP

Daylight Lamp

This carbon dioxide daylight lamp reproduces north sky light, suitable for commercial or industrial use where color is vital. Light produced by a grid of 25 mm. pyrex glass tubing, mounted on white porcelain enameled reflector, attached to metal casing, enclosing electrical connections to lamp from auxiliary transformer equipment. Can be suspended from ceiling or wall or supported by a table. Auxiliary transformer equipment can be installed in any convenient location adjacent to lamp. Barkon-Frink Tube Lighting Corp., Long Island City, N. Y.

Electrode Holder

Type T electrode holder, small, light in weight, comfortable grip, perfect balance, cool, easily operated, for use in all kinds of welding. Spring clamp grips electrode tight, but slight thumb pressure applied to lever handle releases stub, allowing quick change of electrode. Copper-tipped jaws insure maximum conductivity and no sticking of electrode. Makes complete copper, low-resistance circuit direct from welding machine to electrode. Accommodates any size electrode up to and including 3/4-in. and by slightly springing lever, can handle 1/8-in. or 1/4-in. electrodes. Lincoln Electric Company, Cleveland, Ohio.



LINCOLN ELECTRODE HOLDER

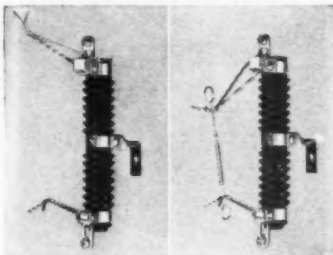
Durheat Lacquers

A line of clear and pigmented air-drying lacquers, designed for finishing electrical equipment and other products subjected to elevated temperatures. Retain flexibility, color and adhesion indefinitely at temperatures up to 300-degrees F. Used for direct and indirect lighting fixtures, lamp enclosures, radiant heaters, electric signs, ranges, ovens and other equipment. Available in clear, black, white and all colors and applied by either dipping or spraying. Maas & Waldstein Company, Newark, N. J.

Electrical Contracting, July 1937

Rural Fuse Cutout

Type MO open link fuse cutouts are designed for transformer installations on rural lines where load is light and short circuit currents are low. A single corrugated insulator carries an upper stationary contact arm and, a lower hinged contact arm of copper-clad steel, each provided with a forked end for holding fuse link. When a link blows, the lower terminal drops further away from the upper terminal. Rated at 25 amp. and made for applications on circuits of 5,000, 7,500/12,500Y and 15,000 volts, and can be supplied for mounting on pole, transformer cross-arm or bushings. Schweitzer & Conrad, Inc., Chicago, Ill.



SCHWEITZER & CONRAD FUSE CUTOUT

Air-Recirculator

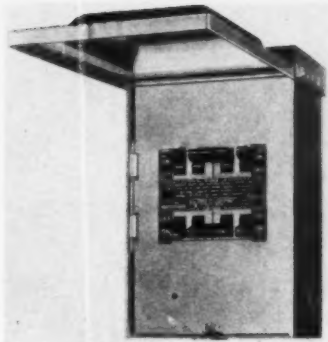
The "Deflecto" Airistocrat is a combination air-recirculator and lighting unit. It draws the cool air from the floor and recirculates it over a wide area. Equipped with two-speed controls—high for sultry months and low for winter months. Available in two models the Candle ARC or Drop Light, ARD in 12-in., 16-in. and 20-in. sizes. Kisco Company, St. Louis, Mo.

KISCO
"DEFLECTO"
AIRISTOCRAT



Raintight Multi-Breaker

Square D multi-breaker service centers, available in raintight boxes for outdoor use up to eight circuits. New boxes include swing-out interior, elevated base, solderless connectors, and accurate calibration. Made of galvanite, which is rust-resisting and finished in baked aluminum. Circuit capacities of 15, 20, 25, 35 or 50 amperes available for either 2-wire or 3-wire solid neutral, 115/230



SQUARE D RAIN-TIGHT MULTI-BREAKER

or volts, a.c. services. Square D Company, Detroit, Michigan.

Handy Saw

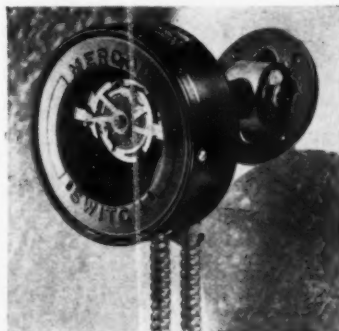
This saw cuts everything but hardened steel. By changing position of blade on handle, cuts may be made in four different directions, without changing position of hand. Handles made of unbreakable malleable iron, saws of tungsten steel with flexible backs and hardened teeth. Ultra Mfg. Co., 226 East 144th St., New York City.



ULTRA ALLWAY HANDY SAW




Twin Automatic Control

Type M-80 combination fan and temperature limit control for warm air furnaces. Has double adjustments permitting individual setting of both high and low operating points. Visible dial provided, calibrated from 50 to 300 degrees. Non-conducting shield prevents any contacts with hot wires, within control case, when adjustments are being made. Particularly adaptable to automatic heating installations. Mercoid Corp., 4201 Belmont Ave., Chicago, Ill.



MERCROID TWIN CONTROL

A post card brings SAMPLES!

- 1  . . . QUICK
- 2  . . . MODERN
- 3  . . . COMPLETE

The **MARR**
A Perfect Joint Connector
(CAP MADE OF BAKELITE)

SAVES MONEY

Don't take our word for it. Prove to yourself how much you'll save with this perfect form of modern "streamline" connector. Send a card today, make more money and get better results by the MARR method.

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GENERAL SALES AGENTS HATHEWAY AND CO.
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